This document is guaranteed to be current only to issue date.

Some Mars Global Surveyor documents that relate to flight operations are under revision to accommodate the recently modified mission plan.

Documents that describe the attributes of the MGS spacecraft are generally up-to-date.

542-409, Volume 6, Part 1

Mars Global Surveyor

Mission Operations Specifications

Volume 6: Test Plan

Part 1: Ground Data System

Update

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Jet Propulsion Laboratory
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MARS GLOBAL SURVEYOR

MISSION OPERATIONS SPECIFICATION

VOLUME 6a

GROUND DATA SYSTEM TEST PLAN

October 18, 1996

JPL D-12369

542-409
MARS GLOBAL SURVEYOR
MISSION OPERATIONS SPECIFICATION, VOLUME 6A
GROUND DATA SYSTEM TEST PLAN

SIGNATURE PAGE

Prepared:

Fred J. Hammer
JPL Ground Data System Lead

Distribution

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R. Leonard	LMA
J. Neumann	LMA
R. Benson	264-214
B. Allen	264-235
R. Southern	264-214
J. Jones	301-235

TABLE OF CONTENTS

1.0 Introduction

1.1 Purpose

This document contains plans for MGS project system-level testing of the Ground Data System (GDS). The GDS includes ground-based hardware, software and networks (including multimission facilities) needed for support of spacecraft integration, test, launch and flight operations. Exceptions include LMA-supplied ground support equipment and science investigator-supplied ground processing components.

1.2 Scope

This test plan covers project-sponsored system-level testing of the GDS. It does not include testing conducted by multimission agencies (e.g. TMOD), nor subsystem testing of project-specific components (e.g. MGS SEQ, MGS Nav, SPAS, etc.). All components are assumed to have been tested at the component and subsystem level, prior to execution of GDS tests.

1.3 Test Objectives

GDS testing is geared toward certification of major GDS deliveries for support of spacecraft I&T (D1.0), MOS-spacecraft compatibility testing and cruise (L1.0), launch operations, cruise and MOI (L1.1 & KSC config), and aerobraking and mapping (E1.0). The ability of the GDS to support operations dataflows and system-level performance are validated.

1.4 Test Strategy

The MGS GDS test approach relies heavily on:

1) End-to-end testing of multimission systems performed by TMOD,

2) The maturity of the MGSO system, as compared to MO,

3) Significant level of inheritance of components previously tested, certified and used for support of MO flight operations,

4) Subsystem testing of project components.

In order to meet the objective of flight operations certification, tests are centered around ATLO and re-engineered flight operations processes. Therefore, ATLO and flight teams heavily participate in GDS testing. The D1.0 system will support the first half of I&T, in parallel with testing of the L1.0 system, which includes 95% of the flight support capabilities. Although not part of the formal GDS test program, heavy utilization of the GDS in ATLO, will help insure that flight support certification objectives are met.

While GDS testing is operations process oriented, the test plan insures that all components, interfaces and functions are exercised, and that system performance requirements are validated. Appendices A-D, contain verification matrices which cross reference these with individual test cases.

1.5 Applicable Documents

1)	542-409, Vol 2	MGS Data System Specification
2)	542-409, Vol 2, Part 1	MGS Software Interface Specifications
3)	Frank Singleton	MGS GDS Workplans (D1.0, L1.0, L1.1, E1.0)

2.0 Ground Data System Description & Plan

2.1 System Overview

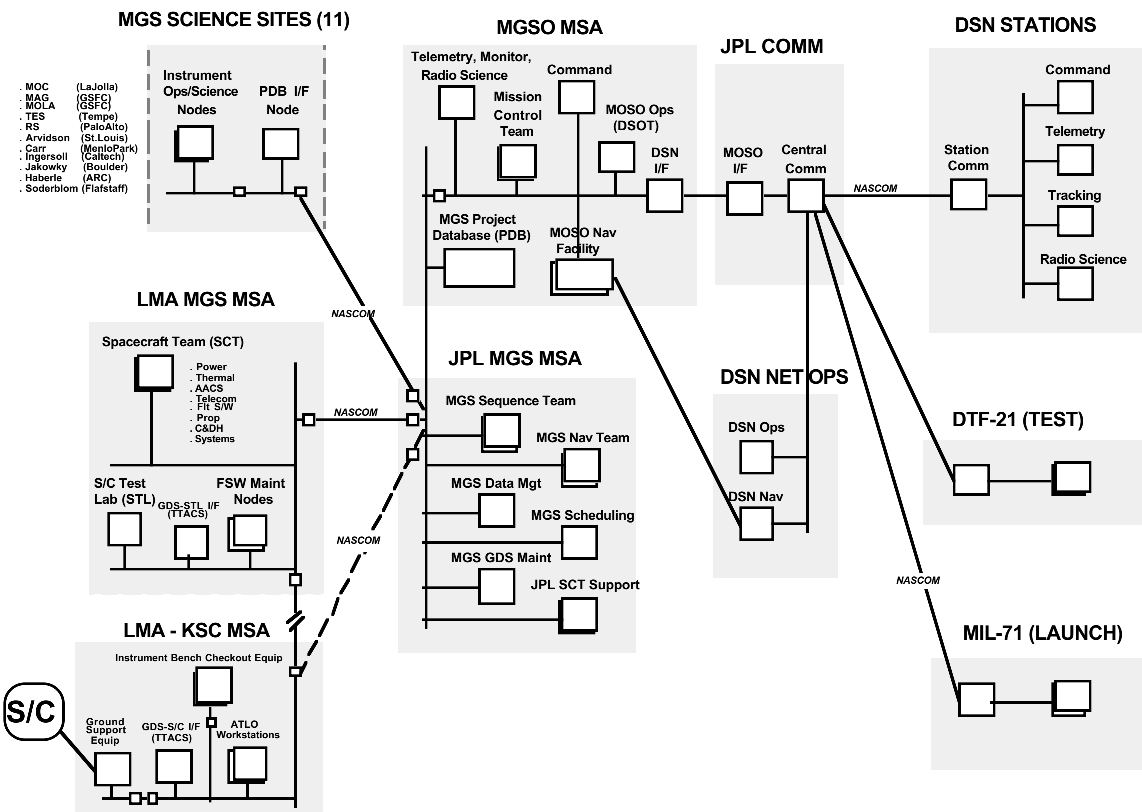


Figure 1 - GDS OVERVIEW

2.2 System Components & Suppliers

All components are exercised during GDS testing. The following is a summary of the high-level GDS components. A complete list is contained in Appendix B.

Component	Provider	% Inherit	Lines of Code	New Capabilities
TMOD Core Systems	MGSO/DSN	98	4M	Reliable Net Services Security Firewall Untimed Commands MGS Tlm/Cmd Formats BWG Antennas
SEQ	MGSO & JPL 314/348	80	200K	Untimed Commands NIPC/EC Automation MGS Cmds/Blocks/Rules
SPAS	LMA	50	70K	MGS S/C Models, Tools
NAV	JPL 312	98	2M	Improved Gravity & Atmos Models
TTACS	MGSO & JPL 394	45	5K	Spacecraft Commanding ATLO/SCC Integration
Enabling Technologies	MGSO, LMA,	45	150K	Operations Automation Command Tracking

2.3 System Interfaces

All interfaces are exercised during GDS testing. System interfaces are listed Appendix C.

2.4 System Functions

All ATLO and Flight operations functions are exercised during GDS testing. Functions, fall into the following categories, and are listed in Appendix D:

Spacecraft Team Functions
Sequence Team Functions
Navigation Functions
Realtime Multimission Downlink Functions
Realtime Uplink Functions
Data Management & Interchange Functions
Operations Management Functions
Science Instrument Operations Functions
ATLO Support Functions

2.5 System Development Phases, Content & Schedule

2.5.1 Development Phases

GDS testing certifies each major GDS delivery for operations support. The GDS deliveries are defined as follows:

Del	GDS Test	D/O	Supports
D1.0	8/1/95	9/21/95	ATLO through L1.0. (Contains 40% of Launch/Cruise System.)
L1.0	11/17/95	2/17/96	MOS-S/C Compat Test, ATLO through L1.1. (Contains 95% of Launch/Cruise System.)
L1.1	6/1/96	7/1/96	Launch Test & Training, ATLO until S/C ship to KSC. (Contains all Launch/Cruse/MOI capabilities except KSC network.)
KSC	8/27/96	9/1/96	ATLO (including Launch) at KSC. (Contains KSC workstations & networks.)
E1.0	3/1/97	4/1/97	Encounter/Mapping Test & Training, Aerobraking, Mapping

2.5.2 System Content

Table 1 lists the content of each the deliveries identified in Section 2.5.1. Figures 2 and 3 show the test configuration for each delivery.

2.5.3 Development Schedule

A Complete GDS development schedule is contained in Figure 4.

Note: For deliveries L1.0 and beyond, the last week or more of the GDS test period, is allocated to “transition”, in which the GDS test system, and operations support configuration, are merged.

Certain GDS tests will be run outside the scope of formal GDS deliveries, when major upgrades to multimission systems take place. These are denoted below as “MM” denoting upgrades to TMOD systems.

D1.0	L1.0	L1.1	E1.0	Post-E1.0
Sequence SW-Development Version	MGSO V21.0	Auto Command Tracker (ACT)	Nav-aero	Reliable Network Services
MGSO TLM V19.0.5	DSN Blk V Rcvr	Peformance Analysis Software - L	Sci-E/IDS HW/SW	BWG-others
TTACS	Sequence SW-mosc	TPAP-L	NAIF/E-k	
Peformance Analysis Software-Development	Peformance Analysis Software - mosc	Sci SW-L	DSN BWG-25/26xd	
Channel Parameter Editor	FSW-auto	GCDR	Sequence SW-Encounter	
Sequence SW-auto	ISA-auto	DSN-sched	MGSO V23.0/RNS	
Sequence SW-review	Nav. SW-L	STL-auto		
		PC-remote Auto-log Auto-alarm Distributed LMA TDS		

Table 1 - GDS OVERVIEW

2.6 Operations Teams

GDS testing is supported by the following ATLO and Flight Operations Teams:

Team	Team Chief	Description
Spacecraft Team (SCT)	J. Neuman	Monitor S/C Health Analyze performance Operate S/C Bus.
Navigation Team (NAVT)	P. Esposito	Generate nav products Plan & analyze maneuvers.
Sequence Team (PST)	R. Brooks	Plan stored sequences, Process uplink requests.
R/T Ops Team (RTO)	J. Neuman	Operate multimission ground systems. Schedule ground resources, Generate SOE's. Monitor S/C health. Transmit commands.
Msn Ops Assurance Team (MOAT)	S. Linick	Anomaly management Command tracking Change management, Data administration
Science Instrument Teams	T. Thorpe	Instrument health monitor and analysis, Instrument operations, Science analysis, product generation & archiving.

3.0 GDS Test Process

3.1 Planning

Test planning, including schedule and resources, is documented and maintained in the GDS test plan. The test plan contains actual test scripts, at a fairly detailed level. The level-of-detail of the test scripts does not, however, include the most detailed scripts for configuration of multimission systems for test support. These are generated in the "preparation" phase, described below.

The final test plan is produced, at the beginning of L1.0 testing. It is complete, in the sense that all testing is described and scheduled and resources negotiated, for all major GDS deliveries.

The test plan is updated prior to, and after each major GDS delivery. The pre-delivery update is part of the preparation phase, and defines new procedures, specific to the phase being tested. The post-delivery update is part of the "analysis & reporting" phase, and corrects discrepancies between the planned and actual test scripts.

3.2 Preparation

Test preparation is conducted during the weeks preceding the actual tests. It includes the following activities:

1) Pre-test phase-specific updates to the test plan.

2) Technical interchange meetings to:

    a) Generate pre-test phase specific updates to test plan,
    b) Generate detailed instructions for multimission configuration/participation (if needed),
    c) Train participants (if needed),
    d) Dry (and/or wet) run procedures (as needed),
    e) Identify final participants, locations and document key information,

3) Generate & validate test data.

4) Establish final test configuration & validate (if needed),

5) Validate basic connectivity and functionality (if needed),

6) Pre-test briefing.

3.3 Execution

Test execution takes place on the day of the test and includes:

1) Verify participants, locations, test preparations, etc.
2) Startup procedures,
3) Test execution (step-by-step),
4) Close-down procedures,
5) Debriefing,

3.4 Analysis, Evaluation & Reporting

Initial analysis of test results will take place at the debriefing (day of test). Based on initial analysis, a **preliminary test report** will be issued within a day or two of the test. Detailed analysis requirements are documented in each test case. Detailed analysis will be completed within a week or two of the test, and a **final test report** will be issued.

4.0 Test Organization

4.1 Test Organization, Roles & Responsibilities

Test Positions, roles and responsibilities are defined as follows:

Position	Individual	Responsibilities
GDS Engineer	F. Hammer	Test approach, Vol 6a outline, intro & appendices,
GDS Test Engineer	R. Southern	Vol 6a coordination and editing, Maintain test schedules, Organize & conduct TIM's, Produce final test reports, Schedule multimission resources & develop detailed specs.
Test Case Engineers	B. Jai	Case #1 (I&T), #4 (Telemetry)
	S. Wissler	Case #2 (Uplink)
	R. Southern	Case #3 (Command)
	B. Allen	Case #4 (Telemetry)
	R. Benson	Case #5 (Tracking & RS)
	A. Bucher	Case #6 (SPAS & SCT)
	R. Southern	Case #6 (End-to end)
	P. Esposito	Case #7 (Nav)
	J. Bottenfield	Case #8 (MOA)
	F. Singleton	Case #9 (Launch)
Test Conductor	R. Southern	Coordinate test preparations, Conduct/Control test execution, Conduct pre-test briefing & post-test debriefings, Produce preliminary test reports.
Test Participants	(see test case)	Test preparation, execution and analysis.

4.2 Supporting Organizations

Organization	**GDS Test Role**
MGS GDS	Plan & execute tests. Transition to new GDS versions.
TMOD (MGSO)	Provide system administration, operations support.
TMOD (DSN)	Provide planning and operations support.
LMA Flight Teams	Provide planning, execution and analysis support. Operate STL.
JPL Flight Teams	Provide planning, execution and analysis support.
Science Instrument Teams	Provide planning, execution and analysis support.
ATLO Teams	Provide planning, execution and analysis support. Operate SCC.

5.0 Test Requirements

Key system "end-to-end" performance requirements are tested at the GDS test level. These are listed in Appendix A.

6.0 Test Cases

There are 9 individual test cases:

Case	Title	Test Engineers	Phases
1)	S/C Integration & Test Dataflow	R. O'Brien/R. Leonard	D1.0, L1.0
2)	Uplink Process Dataflow	S. Wissler	L1.0, L1.1
3)	Command Dataflow	R. Southern	L1.0, MM
4)	Telemetry Dataflow	R. O'Brien/B. Allen	L1.0, E1.0, MM
5)	Tracking & RS Dataflow	R. Benson	L1.0,MM
6)	Downlink Dataflow	F. Hammer, A. Bucher, J. Jones	L1.0, L1.1, E1.0
7)	Navigation Dataflow	P. Esposito	L1.0, E1.0
8)	Mission Ops Assurance Dataflow	S. Linick	L1.1
9)	KSC/Launch Dataflow	F. Singleton	KSC

(MM denotes tests which may need to be run, due to significant multimission (TMOD) upgrades.)

Each test case includes the following sections:

1) Test overview (objectives, description)
2) Test Configuration (hardware, network, software)
3) Test Participants
4) Test Data
5) Test Scenario (preparation, execution, analysis)
6) Test success criteria

A test may have several parts. If so the parts are defined in section 1, and sections 5 and 6 are subdivided by part.

6.1 Test Case #1: SC Integration & Testing

6.1.1 Overview

Telemetry data will originate at Lockheed-Martin Astronautics (LMA) from Test Equipment of MSP 98. The telemetry data will be processed by the TTACS system at LMA Denver and stored on a TDS at Denver. MGS workstations at JPL will be able to access the data both in realtime and at the Denver TDS.

A. Test Objectives

Exercise and validate the data flows that will be used by JPL and Lockheed-Martin for MSP 98 STL/FSW development.

B. Test Description

This test has 2 parts:

(1) TTACS Telemetry Data Flow

This test validates the downlink dataflow for STL using test equipment with personnel & equipment at JPL, and LMA.

- Basic Downlink Test Procedure
  - Configure Test for STL
  - Bring up Denver Stream
  - Load data to Denver TDS & broadcast data
- Repeat the Basic Test Procedure using the Telenex(if necessary.) as the telemetry data source.

(2) TTACS Uplink Dataflow

This test requires the test conductor to retrieve SCMFs stored on TBD and transmit them to the test equipment of and the UconX box. Test equipment will be used to validate that the data is transferred through the UconX box in the intended format.

6.1.2 Test Configuration

A. Hardware/Network

- 1 UconX boxes will be required to support the MSP STL.
- The Operational Network will be configured to allow MSP 98 broadcast channels and virtual circuits o be visible across the Multimission Operations LAN, the MGS Operations LAN (at both JPL and at LMA Denver).
- Telenex Test Equipment will be required to allow the staging of test data from the UconX.
- 2 Sparc 20 TTACS workstations - One loaded with TTI, TCI, SEQ software and other MGDS utilities, and the other loaded with TDS
- 2 Sparc 5 TTACS workstations - One loaded with TIS and the other loaded with SCT compatible software.
- 1 SCT workstation - TBD
- 1 GDS test workstation at JPL - TBD

B. Software

- MGDS DDO V21.4
- MGS TTACS System 2.0 and supporting UconX software.
- Telenex Software Support
- MGDS MP&S V21

6.1.3 Test Participants

A. Test Engineers

RO Robin O'Brien
BA Bryan Allen
SW Steve Wissler

B. Test Conductor

RJS Richard Southern

C. Multimission Support

TB Tom Boreham
MF Mike Fitzpatrick

D. Project GDS Support

RL Rob Leonard

E. Project User Support

TBD

6.1.4 Test Data

Test data will be generated in realtime by the Telenex equipment and replayed back through the UconX during the actual GDS test.

6.1.5 Test Scenario

Testing will consist of 2 parts:

- TTACS Telemetry Data Flow
- TTACS Uplink data flow

TTACS Telemetry Processing encompasses a basic test that is conducted using data from Telenex test equipment and played back through the UconX box at a later time to simulate the realtime test. The basic test consists of processing (TTI and TIS) and storing (TDS) Integration and Test Data at LMA and having the processed data visible at JPL and Denver in realtime (from broadcast data) and near realtime at JPL

TTACS Uplink data flow validates the command dataflow for STL (using Telenex). Using the TCI software delivered with TTACS, the test conductor can send a command to the Test equipment. The command can be validated by capturing the data on the Telenex box after it has gone through the UconX box. Once captured, the data can then be compared to the contents of the original SCMF file sent to verify that the two are equivalent.

PART I

A. Preparation

- Prepare one hour worth of MGS telemetry data.
- Validate A1.0 installation and delivery.
- Configure and validate routers.
- Configure and validate TTACS installation
- Build a sample DMD display; should include plot, message page and ecdr output to a file. The DMD message page should log the packets RCT along with the current system time at the DMD - this will be used to measure latency in the system.
    - Configure DMD @ JPL Workstation
    - Configure DMD @ LMA Workstation
- Put Telenex Box in place if necessary

B. Execution

Startup:

- Reboot machines being used for data processing
- Kill & Restart SFOC Services on nodes that will be running TIS
- Power Cycle UconX Box
- Start UconX Demon
- Bring up DMDs
- Bring up Denver TDS
- Bring up stream 1 (ttrun)
- Bring up JPL TIS using VC TTIVC2 as input

C. Analysis

- Review DMD output from SCT workstations and TTACS User workstation.

PART II

A. Preparation

- Setup Telenex so that it can capture data as the command flows out of the UconX box to the Telenex.
- Setup UconX box in physical configuration to support command transmittal to the Telenex.
- Prepare a sample SASF and stored on the user workstation.

B. Execution

- Test director converts SASF to SCMF
- Test director sends to SCMF to STL/SCC via TTACS TCI.

C. Analysis

- Compare the data captured by the Telenex to the original SCMF.

6.1.6 Test Success Criteria

- Data output by the Denver TIS is considered to be the Baseline case.
- Data in the Denver TDS matches the records produced by the Baseline case.
- Latency at the Denver DMD is within TBD (Note: Since the DMDs will be run off of broadcast data, delivery is not guaranteed, so DMD output will not necessarily match the Baseline case.)
- Data lost at the Denver DMD is within an acceptable limit (TBD).
- Latency at the JPL DMD is within TBD
- Data lost at the JPL DMD is within an acceptable limit (TBD).

6.2 Test Case #2: Uplink Process

6.2.1 Test Overview

A. Test Objectives

Validate the Planning and Sequencing software and interfaces. Including the NIPC/EC process, the IC process, stored sequence generation, SOE generation, FNS and ACT.

B. Test Description

The test has 3 parts:

1) Generation of commands using the NIPC and EC process.

2) Generation of Interactive Commands (IC).

3) Generation of stored sequences and SOEs.

6.2.2 Test Configuration

A. Hardware/Network

See Figure 5

B. Software

See Figure 6

6.2.3 Test Participants

A. Test Conductor

SW	Steven Wissler	JPL GDS

B. Project GDS Support

JJ	Jeff Jones	JPL Science Support
DH	Dan Hurley	JPL ACT Engineer

E. Project User Support

TR	Tim Reyes	MAG GDS	SIT
GE	Greg Elman	MOLA GDS	SIT
MC	Mike Caplinger	MOC GDS	SIT
NG	Noel Gorelick	TES GDS	SIT

JC	John Callas	JPL SIT
RS	Richard Springer	JPL SIT
MM	Michele Miller	SLMAACT
RB	Robert Brooks	JPL PST Team Chief
PC	Pete Carberry	JPL PST
AB	Anne Bunker	JPL PST
JM	Judy Morris	JPL PST
BW	Bruce Waggoner	JPL PST
GV	Geoffrey Vaughan	JPL SEGS

6.2.4 Test Data

PART I - Non-Interactive Payload and Express Commanding.

File Type	File Name
Science SASF's on this SOPC and ER workstations.	TBD
Star table SASF from SCT.	star.GDS.test.sasf
Ephemeris table SASF from SCT.	trans.GDS.test.sasf

PART II- Interactive Commanding.

File Type	File Name
Science SASF's on this SOPC and ER workstations.	TBD
Star table SASF from SCT.	TBD
Ephemeris table SASF from SCT.	TBD

PART III - Stored Sequence Commanding.

Test III.1 TCM1 Sequence

File Type	File Name
sequence SASF on MGSEQ2 workstation.	s0105
SCLK file from SCT	SCLK_SCET.94
Light time file from NAV.	ltm_c_961105-961130_geo_MOSC
DSN Viewperiods File	095_096.vue

DSN Allocations File	96459648.txt

Test III.2MOI Sequence

File Type	File Name
sequence SASF on MGSEQ2 workstation.	s0205
SCLK file from SCT	SCLK_SCET.94
Light time file from NAV.	ltm_c_970901-970920_geo_MOSC
DSN Viewperiods File	095_097.vue
DSN Allocations File	97369738.tx2

Test III.3 Aerobraking Sequence

File Type	File Name
sequence SASF on MGSEQ2 workstation.	s0303/s0306
SCLK file from SCT	SCLK_SCET.94
Light time file from NAV.	ltm_i_971228-971231_geo_MOSC
DSN Viewperiods File	95_dec97.vue
DSN Allocations File	97529753.txt
OPTG file from NAV	optg_i_971228-971231_MOSC

Test III.4 Mapping Transition Sequence

File Type	File Name
Sequence SASFs on MGSEQ2 workstation.	s0405/s0503
SCLK file from SCT	SCLK_SCET.94
Light time file on PDB.	ltm_i_980301-980318_geo_MOSC
DSN Viewperiods File	mar98_94.vue
DSN Allocations File	98109812.txt
OPTG file from NAV	optg_i_980301-980318_MOSC

6.2.5 Test Scenario

PART I - NIPC/EC Commanding.

SASF’s are prepared at the SOPC’s, and the ER Workstations and the SCT Workstation. The send_nipcec script is executed, which transfers the SASF’s to the PDB and generates and sends the SASF FRF’s to the SEQ Daemon, which creates GCMD’s on the PDB. Then the originator is notified “command request complete” via ELM and the MCT is notified via ACT.

A. Preparation

1)	SEQ	Configure NIPC process on MGSEQ2 to support L1.1 Testing.
2)	SEQ,SIT	Verify SASF files are not already on the PDB, If they are delete them.

B. Execution

<u>Startup</u>:

1)	SEQ	Start SEQ Daemon on MGSEQ2 and initialize kerberos.
2)	SCT,SIT	SOPC/SCT/ER generate SASF’s.
3)	“	SOPC/SCT/ER execute send_nipcec and SCT execute resulting in: a) SASF’s sent to PDB, b) SASF FRF’s sent to SEQ Daemon, c) GCMD’s created on PDB, d) ACT notification to MCT. e) ELM “Command request complete (ready to send)” sent to originator .
4)	“	Originators verify receipt of “CR complete” ELM. The ECRF number will be in the CR completion email. Bring up ACT and use this ECRF number to verify the command request. For user accounts set up as group/team accounts, use the run.act script.
5)*	RTO	Verify ACT notification to RTO. Bring up ACT (run.act) and verify ecrf information. Extract GCMD from the PDB and radiate. Put GCMD back onto PDB.
6)	SCT, SIT	SOPC/SCT/ER Verify radiation verification e-mail receipt.

* This step will be done as part of Test Case #3, Command Data Flow

PART II - Interactive Commanding.

SASF’s are prepared at the SCT Workstation. The send_ic script is executed, which transfers the SASF’s to the PDB and generates and sends the SASF FRF’s to the SEQ Daemon, which creates GCMD’s on the PDB. Then the originator is notified “command request complete” via ELM and the SEQ team is notified via ACT that an Interactive command request is ready for merge/check. The SEQ team then merges/checks the Interactive command sasf, then using ACT sends the ECRF onto the SCT for inputs. The SCT then checks out the ECRF, adds any additional information and sends the ECRF on to Flight Team Review. The Flight Team (SCT and SIT) will then check out the ECRF, add any comments and send the ECRF on to the FOM for approval. The FOM will then approve the ECRF for radiation using ACT. RTO will then be notified by ACT. RTO will then pull the GCMD from the PDB and radiate the file. The GCMD will then be updated and replaced onto the PDB. The SCT will then be notified via the SEQ Daemon that the commands have been radiated.

A. Preparation

SCT	MM	Verify SASF files are not already on the PDB, If they are delete them.

B. Execution

Startup:

1)	SEQ	Start SEQ Daemon on MGSEQ2 and initialize kerberos.
2)	SCT	SCT generate SASF's.
3)	"	SCT execute send_ic resulting in: a) SASF's sent to PDB, b) SASF FRF's sent to SEQ Daemon, c) GCMD's created on PDB, d) ACT notification to SEQ. e) ELM "Command request complete (ready to send)" sent to originator .
4)	"	Originators verify receipt of "CR complete" ELM. The ECRF number will be in the CR completion email. Bring up ACT and use this ECRF number to verify the command request. For user accounts set up as group/team accounts, use the run.act script.
	SEQ	Merge and check IC command request
	SEQ	Using ACT check out ECRF, then check back in sending to SCT Inputs
	SCT	Using ACT check out ECRF, then check back in sending to Flight Team Review
	SCT,SIT	Using ACT check out ECRF, then check back in sending to Radiation Approval
	FOM	Using ACT check out ECRF, then check back in sending to Radiation
5)*	RTO	Verify ACT notification to RTO. Bring up ACT (run.act) and verify ecrf information. Extract GCMD from the PDB and radiate. Put GCMD back onto PDB.
6)	SCT	Verify radiation verification e-mail receipt.

* This step will be done as part of Test Case #3, Command Data Flow

PART III

Test III.1 Stored Sequences

A. Preparation

1)	PC,AB,JM, BW	Ensure appropriate inputs are stored on the PDB.
2)	"	Update SASF files for block dictionary changes.

B. Execution

1)	SEQ	Pull input files from PDB and generate seqgen environment file (env_gen).
2)	SEQ	Generate ssf and pef (seqgen).
3)	SEQ	Review Seqgen products.
4)	SEQ	Run Seqtran/cmd_reformat (run.seqtran.all).
5)	SEQ	Review Seqtran products.
6)	SEQ	Generate SOE and SFOS.(dosegs "seq_id")
7)	SEQ	Store output products on the PDB (pdb_store).
8)	SEQ	Enter sequence data into ACT (act) and check in ECRF ->Flight Team Review

Pass 1.

The remaining steps will be performed only on the TCM1 (s0105) sequence.

9)	SCT/SIT	Flight Team check out ECRF, verify information and check ECRF back in -> SEQ Processing Pass 2.
10)	SEQ	SEQ team check out ECRF, verify information and check ECRF back in -> Flight Team review, Pass 2
11)	SCT/SIT	Flight Team check out ECRF, verify information, extract PEF from PDB and examine. Check ECRF back in -> SEQ Processing Pass 3.
12)	SEQ	SEQ team check out ECRF, verify information and check ECRF back in -> Flight Team review, Pass 3
13)	SCT/SIT	Flight Team check out ECRF, verify information and check ECRF back in -> Request Approval.
14)	FOM	FOM check out ECRF, verify information and check ECRF back in -> Request Radiation.
15)*	RTO	Verify ACT notification to RTO. Extract GCMD and radiate. Put GCMD back onto PDB.
16)	SCT/SIT	Extract SOE and SFOS and examine using the following commands: cdb_wotu... Extract s0105.soe and s0105.sfos soeedt s0105.soe sfosedt s0105.sfos

* This step will be done as part of Test Case #3, Command Data Flow

6.2.6 Test Success Criteria

PART I - NIPC/EC Commanding.

1) SASF's generated and stored on the PDB.
2) GCMD's are generated by NIPC/EC process and stored on PDB.
3) Participants are properly notified via e-mail during processing of NIPC/EC's.
4) RTO is properly notified by ACT and FNS/SEQ Daemon update radiation log and notify requester that commands were radiated

PART III- Stored Sequence Processing

1) Verify appropriate input files were selected and pulled from pdb by env_gen.
2) Verify ssf files match the L1.0/MOSC tests with any noted exceptions from block dictionary updates.
3) Verify scmf files match pef.
4) Verify SOE and SFOS generated properly.
5) Verify all products stored successfuly on PDB.
6) Verify ACT notifies proper team at each step of the Sequence review cycle.
7) Verify FNS/SEQ Daemon updates radiation log.

6.2.7 Test Schedule

Stored Sequence Tests	June 3 - June 7, ACT Steps for TCM1 sequence TBD
NIPC/EC Tests	TBD

6.3 Test Case #3: Command Dataflow

6.3.1 Test Overview

A. Test Objectives

Validate GDS dataflows associated with TMOD's real-time command processing and monitor data delivery. This test (with appropriate variations) will be conducted in conjunction with GDS L1.0 and GDS E1.0 testing.

B. Test Description

Use CMD_DSN's stored on the PDB, some maybe supplied from Test Case #2 Uplink Process, to validate the command dataflow. The following tasks will be performed in Test Case #3:

1) LMA extract command files (cmd_dsn) from the PDB.

2) Validate command interface with DSN, LMA, & MGSO.

3) Transmit command files to DSN and radiate to water load.

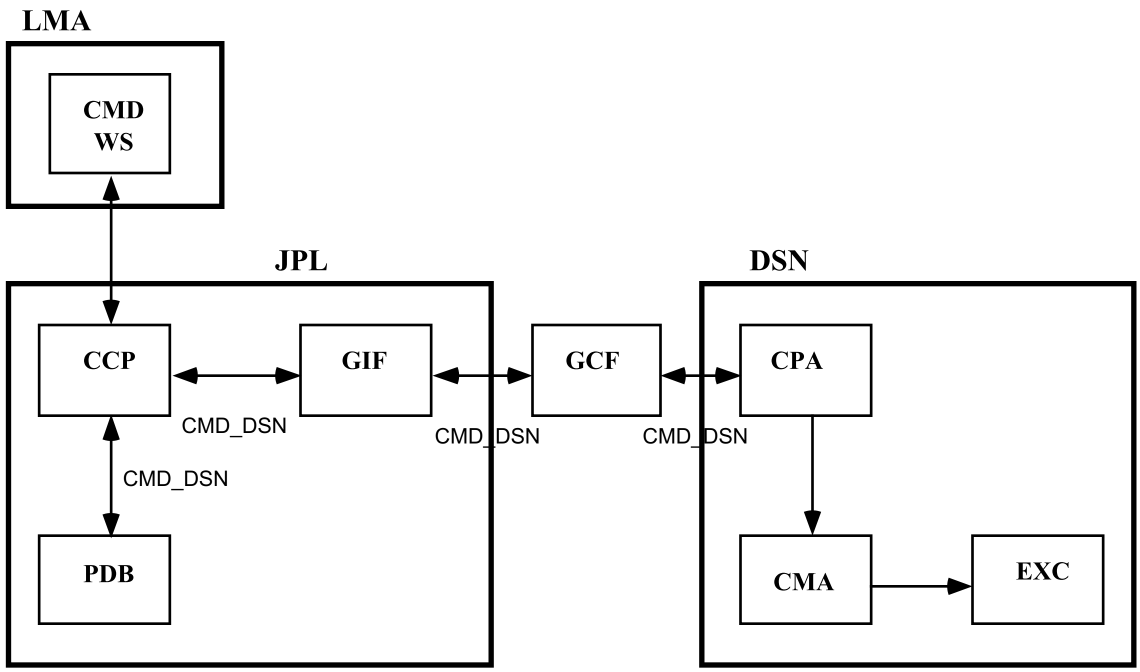
4) Validate DSN command monitor data.

This test case will be run together with Test Case #4 and #5 during scheduled DSS periods to make the most of station and network resources.

6.3.2 Test Configuration

A. Hardware/Network

See Figure 2 for a detailed hardware and network diagram. The standard flight configuration will be used for this test, no special configuration other than that shown in the workplan is necessary for this test.



CCP = Command Central Processor
CMD WS = Command Workstation
GIF = GCF Interface Facility
PDB = Project Data Base

CMA = Command Modulation Assembly
CPA = Coomand Processor Assembly
EXC = Exciter

Figure 2 - Command Dataflow

B. Software

See the Figure (TBD) for a description of the baseline software for L1.0.

6.3.3 Test Participants

A. Test Engineers

TC Richard Southern JPL GDS Test Engineer

B. Test Conductor

TC Richard Southern JPL GDS Test Engineer

C. Multimission Support

Data Control	Tom Boreham	DSOT
NOPE	Dave Recce	DSN NOPE
NOPE	Mike Kennedy	DSN NOPE
NOPE	Doug Dillard	DSN NOPE
YL *	Young Lee	MGSO DDO
AK *	Annabel Kennedy	MGSO DDO

D. Project LMA Support

RTO	A. Bucher	SCT
RTO	M. Cox	SCT
RTO	B. Goddard	SCT
RTO	R. Leonard	SCT
RTO	K. Martin	SCT
RTO	M. Miller	SCT

* No net activity.

6.3.4 Test Data

The CMD_DSN can be the found on the PDB, there will be other command generated during the Uplink Dataflow-Test Case #2 which will be identified prior or during the test by the TC. The following is a list of CMD_DSN which will be used during the test.

LRGBLD10
NC000802
NC000803
aerobrk03

6.3.5 Test Scenario

A. Preparation (to be completed at least 48 hours prior to test execution)

1) TC Verify that correct CMD_DSN's are stored on the PDB

B. Execution

Startup:

2) RTO Request status of cmd system from DSS
3) RTO Request command communicator from data control
4) RTO When DSS has green cmd system request Data Control to do a cmd validation.
5) RTO Login to command central and verify green command system.

Move and Format SCMFs to cmd_dsn

6) RTO Get command files from PDB.
LRGBLD10
LRGBLD11
LRGBLD12
NC000802
NC000803
aerobrk03

7) RTO Verify all files is at command WS.

Configure Command System:

8) RTO Take CMA to Idle1.
9) RTO Verify command transmitter on
10) RTO Verify command modulation on
11) RTO Transmit files to CPA and verify.
12) RTO Attach NC000802 to queue.
13) RTO Take CMA to Idle2.

Command Nominal (Non-Timed):

14) RTO Take CMA to Active.
15) RTO Verify that commands have begun to radiate.
16) RTO Verify that command confirmations are being seen on command WS.
17) RTO Notify Test Conductor when all commands have radiated.

Uplink Bit Rate Change

18) RTO Change the radiation data rate to 62.500
19) RTO Attach NC000802 to queue.
20) RTO Take CMA to Active.
21) RTO Verify that command confirmations are being seen on command WS.
22) RTO Notify TC when the last command element confirmation is received.
23) RTO Take CMA to IDLE1

Command Suspend and Resume:

24) RTO Attach LRGBLD10
25) RTO Move CMA to IDLE2
26) RTO Move CMA to ACTIVE
27) RTO Verify commands are radiating.
28) RTO While commands are radiating, suspend commanding
29) RTO Verify commanding has been suspended, note last command transmitted.
30) RTO Resume commanding with next element.
31) RTO Verify commands are again radiating
32) RTO Perform another suspend, resume commanding with a future element.
33) RTO Verify commands are again radiating.
34) RTO Notify Test Conductor when Step 33 has been completed.

Command Abort:

35) RTO While commands are radiating, abort commanding
36) RTO Verify commanding has been aborted
37) RTO Verify commands in queue have been suspended
38) RTO Verify CMA has returned to Idle1.
39) RTO Notify Test Conductor when Step 38 has been completed.
40) RTO Move CMA to Active and resume commanding of the aborted file.
41) RTO Verify commanding has resumed and the first command after the abort did confirm.
42) RTO Notify TC when completed and let command file continue until completion.
43) RTO Place all radiated files onto the PDB. Notify TC when complete.

Verify Monitor Data (Mon 5-15)

44) RTO Using the CMD display window verify that the Mon 5-15 data is being displayed correctly.

6.3.6 Test Success Criteria

The Command Dataflow Test must demonstrate the following capabilities:

1) Verify RTO at LMA can configure and operate command system.
2) Access and configure DSN for commanding.
3) Transfer CMD_DSN files from PDB to cmd_ws.
4) Load command queue with multiple files.
5) Radiate command files representative of flight sequences.
6) Suspend and abort commanding. In the case of suspend the ability to resume commanding.
7) Radiate commands at different uplink data rates.

6.4 Test Case #4: Telemetry Dataflow

6.4.1 Overview

A. Test Objectives

Process and distribute data within the MGS Ground Data System, utilizing all the pathways which will be used by the Project telemetry during Flight Operations(see figure: “Data Flow for Telemetry Tests”). Flow data to the PDB and display it in real-time. Measure data quality and display latencies. Validate dataflows associated with telemetry processing. Involve Science sites and ERs in testing and validation. This test is part of the MGS GDS L1.1 testing.

Additionally, this test involves validating the system configuration where the LMA Spacecraft Team queries the local Denver TDS, which is in turn loaded from JPL. Two things will be shown: (1) timeliness of data loaded in the Denver TDS versus the JPL TDS (2) robustness of recovery when either Denver TDS or JPL Master TDS nodes are brought down and restarted.

B. Test Description

Project data will be staged at each two DSCC locations (Goldstone & Canberra, DSS 15 & 65.) Eight tasks will be performed:

1) Exercise dataflows associated with station configuration & setup for telemetry acquisition
2) Process telemetry using selected valid rates & formats, noting system performance while checking for suspect data and packet quality
3) Verify that SOPCs are able to receive desired data products in a timely fashion
4) Display real-time engineering channels at LMA & JPL nodes
5) Deliver engineering channels & packets to PDB and measure delivery latencies
6) Reliably deliver instrument packets to PDB
7) Disable and restart slave TDS at Denver, and disable & restart master TDS at JPL, to document the ability of the system to recover gracefully with no loss of data
8) Generate DSN telemetry monitor data and deliver it to the Mission Control Team (MCT), Spacecraft Teams (SCT) at both JPL and LMA, and PDBs (TDS) resident at both JPL and LMA.

This test case will be run together with Test Case #3 and #5 during scheduled DSS periods to make the most of station, personnel, and network resources.

6.4.2 Test Configuration

A. Hardware & Network

See the “MGS GDS L1.1 Workplan” for a detailed hardware and network diagram. No special configuration other than that shown in the workplan is necessary for this test.

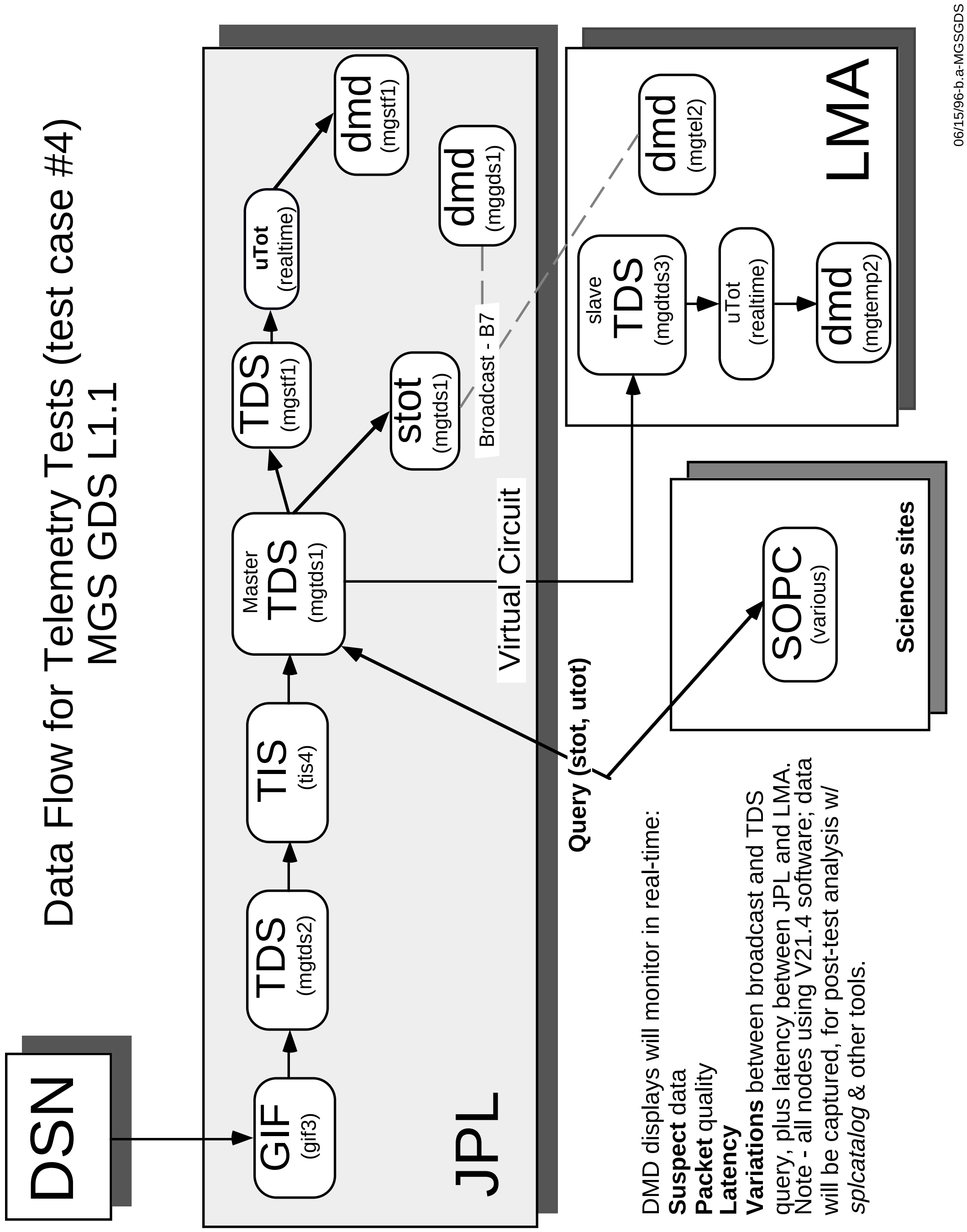


Figure 3 - Telemetry Dataflow

B. Software

See the "MGS GDS L1.0 Workplan" for a description of the baseline software for L1.0. Additionally, there will be a prototype of a distributed TDS located at Denver. See Figure *xx*, "L1.0 Telemetry Dataflow diagram", which shows prototype processes and the nodes involved.

6.4.3 Test Participants

Init.	Name(title)	Call sign
A. GDS Test Engineers		
RO	Robin O'Brien	GDS Test
BA	Bryan Allen	GDS Test
B. Test Conductor		
RJS	Richard Southern	Test Conductor
C. Multimission Support		
TB	Tom Boreham (DSOT)	Data Control
DR	Dave Recce (NOPE)	DSN NOPE
RTO	LMA RTO	RTO
D. Project GDS Support		
RL	Rob Leonard	
E. Project User Support		
CW	Charles Whetsel	
F. SOPC Support (PIs)		
JJ	Jeff Jones	JPL Science Support Engineer
TR	Tim Reyes	MAG
MC	Mike Caplinger	MOC
JW	Jeff Warren	MOC
GE	Greg Elman	MOLA
PJ	Peggy Jester	MOLA
DS	Dick Simpson	RS
JT	Joseph Twicken	RS
NG	Noel Gorelick	TES

G. ER Support

TT	Tom Thorpe	Science System Mgr
DW	Dan Winterhalter	MAG
RS	Rich Springer	MOC
BB	Bruce Banerdt	MOLA
MC	Mick Connally	RS
JC	John Callas	TES

6.4.4 Test Data

Mars Global Surveyor has several data types and rates. Six representative examples will be used in this test. Specifics:

Data Type	Rate (bits/second)	Source File (DSN name)
Engineering	2000 bps	2Kscp_tlm.96.083.TtiOut (.sym)
Engineering	250 bps	250bps.96.083.TtiOut (.sym)
Emergency-mode	10 bps	emerg96.096.sl.TtiOut (.sym)
Science & Engineering-1	4000 bps	SE4K_96.155.allInst.TtiOut (.sym)
Science & Engineering-2	40,000 bps	SE_40K.TtiOut (se40k.sym)
Science & Engineering-2	80,000 bps	SE_80K.TtiOut (se80k.sym)

All data is from the MGS spacecraft, captured during various ATLO tests while at LMA.

6.4.5 Test Scenario

PART I

A. Preparation

one week before:

1.	BA, RO	Process data sets locally at JPL; record statistics on output (i.e. number of packets, clock ranges, etc.); this will be the baseline case (mostly done)
2.	DR	Arrange for Monitor data from station
3.	RJS	Verify station schedule
4.	BA, RO, RJS	Strip SFDU headers from data sets and place data in “/u/data/data_archive/mgs/dsot” directory on mggds1
5.	TB	Convolutionally encode ENG and Emergency data to be sent to the station
6.	TB	Transfer data to DSN, via ftp
7.	DR	Verify data arrival and archiving onto 8mm tapes at DSN stations

Two working days before:

1.	BA, RO, RL	Prepare DMD for monitoring data
2.	RO, BA, RL	Install and configure MGS Operational System
3.	TB	Bring up V21.4 TDS and, if needed, clear out prior data
4.	TB	Configure TIS Script to save all packets, qqc, monitor in-sync frames, out-of

		sync frames and invalid frames, and invalid packets to local files
5.	TB	Verify that TIS script sends data to JPL TDS and that broadcast from the master TDS on MGSTISB7 is enabled
6.	TB	Verify that TIS script sends data to Denver SCT TDS also, for purposes of testing prototype TDS configuration
7.	DR	Verify data and test scripts are in place at participating DSN stations.

Day of test:

1.	DR, RJS	Verify data is on TSA-II disk at DSS site
2.	TB	Verify master & slave TDSs ready to receive data, GIF and TIS in place and ready
3.	TB	Verify correct MGS decom maps in place
4.	BA, RO	Set up DMDs on MGS LAN at JPL
5.	RL	Set up DMD on MGS LAN at Denver
6.	BA, RO	Set up query at JPL (to JPL TDS)
7.	RL	Set up query at Denver (to Denver SCT TDS)
8.	RL	Set up query at Denver (to JPL TDS)
9.	JJ, PIs	Set up queries on SOPCs
10.	RJS	Establish/oversee voice links between JPL, LMA Denver, and DSN
11.	ALL	Verify readiness to start tests

B. Execution

1.	RJS	Request start of 2000 bps Engineering data transmission; expected duration **45** min.
2.	TB	Verify reception of data via TIS, note time
3.	BA, RO	Verify reception of TDS broadcast, note time
4.	BA, RO, RL	Verify reception of valid DMD data
5.	JJ, PIs	Issue and validate SOPC query of TDS
6.	BA, RL	Do reality-check of received data, verifying that it is being written out to files and that frame and packet-count, along with sync vs. out-of-sync, seem to correspond to baseline case
7.	RJS	Request termination of 2K Engineering data flow
8.	ALL	Terminate respective processes, move data files to storage directories if needed
9.	RJS	Request start of 250 bps engineering data flow; expected duration **30** minutes
10.	BA, RO, TB	Verify JPL TDS is broadcasting channelized data
11.	RL	Verify Denver TDS is loading eng & sci packets and broadcasting
12.	BA, RO, TB	Verify JPL TDS is loading eng & sci packets
13.	JJ, PIs	Query TDS from SOPCs
14.	RJS	Request termination of 250 bps Engineering data flow
15.	ALL	Terminate respective processes, move data files to storage directories if needed
16.	RJS	Request start of Emergency data flow, 10 bps rate; expected duration **30** minutes
17.	ALL	Perform “Execution” steps 2-6 again for this data
18.	RJS	Request termination of Emergency data flow
19.	RJS	Request start of SE-1 4K file; expected duration **2** hours (**120** minutes)
20.	ALL	Perform “Execution” steps 2-6 again for this data
21.	JJ, PIs, ERs	Verify receipt and processing of valid science packets

22. TB Kill TDS process in Denver
23. RL, BA, RO Verify loss of broadcast in Denver, request TB to restart Denver TDS
24. TB Restart Denver TDS
25. RL, BA, RO Verify that Denver TDS has resumed and re-connected to JPL master, no data gaps
26. TB Kill TDS master-prime process at JPL
27. ALL Verify that TDS master-backup has kicked in, no apparent loss of data
28. TB Restart TDS master prime process at JPL
29. RJS Request termination of SE-1 4K data flow
30. RJS Request start of SE-2 40K file; expected duration **30** minutes
31. ALL Perform "Execution" steps 2-6 again for this data, and where applicable, SOPCs should verify receipt of valid instrument packets
32. RJS Request termination of SE-2 40K file
33. RJS Request start of SE-2 80K file; expected duration **60** minutes
34. ALL Perform "Execution" steps 2-6 again for this data, and where applicable, SOPCs should verify receipt of valid instrument packets
35. RJS Request termination of SE-2 80K file; thank participants

C. Analysis

1.	RL, BA	Look at TIS output Files: clock range and number of packets by packet type. Compare to baseline case.
2.	RL, BA, TB	Examine contents of JPL TDS and Denver TDS for current day
3.	JJ, PIs	Inspect SOPC queries: number of packets and clock range
4.	CW, TB	Look at JPL query output for JPL TDS and Denver TDS
5.	RL, RO, BA	Look at Denver query output for JPL TDS and Denver TDS
6.	RL, TB, BA, RO	Look at DMD ecdr output at DMD workstations. Measure latency between packet creation and when packet was transmitted from the DSN
7.	ALL	Forward test reports to Test Conductor (RJS).

6.4.6 Test Success Criteria

1. Dataflow from beginning to end of test space (see Figure *x*)
2. Successful stop and restart of TDS processes at Denver and JPL without excessive delays or data loss
3. Participation by all instrument teams (SOPCs) and ERs, with successful receipt and processing of science products
4. Valid data received at each step, as verified by packet count in TDS, engineering channel displays, and other metrics including comparison with baseline data as typlified with splcatalog and other tools
   a. engineering data correctly decommutated, displayed, and stored
   b. science packets correctly delivered to SOPCs
   c. no excessive end-to-end delays

6.5 Test Case #5: Tracking and Radio Science Dataflow

6.5.1 Test Overview

A. Test Objectives

Validate GDS dataflows associated with TMOD's generation and processing of tracking data, monitor data, and radio science data. A secondary objective is to validate dataflows which support the planning and scheduling of tracking resources (i.e., DSN stations). Specific objectives for this test are contained in section 6.1.6. This test will be conducted in conjunction with GDS L1.0 testing and (with appropriate variations) to validate overall performance following TMOD upgrades.

B. Test Description

The test has six parts:

1) Planning and allocation of tracking station **resources**.

2) Delivery of **pre-pass products** to the Deep Space Network (DSN)

3) **Configuring** of station, Ground Communication Facility (GCF), and multimission ground data system (MGDS) for the test activity.

4) Realtime processing of **tracking data** and delivery to the Project Database and Navigation Analysis System.

5) Realtime processing of **radio science data** and delivery to the Project Database and Radio Science Support Team.

6) Generation of DSN radiometric **monitor** data

Test cases 3 (command), 4 (telemetry), and 5 (this test) will be run together during scheduled station periods to demonstrate realtime command, telemetry, and radiometic data flows in a realistic scenario. The initial test is scheduled with DSS 65 (34M HEF) on Monday 27 Nov 95 (331/1500Z - 0015). DSS 15 (34M HEF) is scheduled for 12 December and DSS 63 (70M) is scheduled for 20 December. (During the course of L1.0 testing, each Deep Space Communications Complex (DSCC) will be exercised. The 34 meter High Efficiency (HEF) stations and Block V receivers are the primary test subjects; the 34 meter beam waveguide stations and the 70 meter stations should be tested also.

Each part may have some variations, depending on whether the test is being conducted as part of the L1.0 GDS test period or as a regression test following changes to the TMOD system.

6.5.2 Test Configuration

A. Hardware/Network

Figure 6.5-1 (4.5.5) depicts the L1.0 configuration for Tracking Data. Figure 6.5-2 (4.5.6) shows the configuration for Radio Science Data. Figure 6.5-3 (4.5.2) shows the configuration for Monitor Data. The system L1.0 hardware/network configuration is defined in more detail in "MGS GDS L1.0 Workplan".

Notes: The following are required

1) Block V receiver for realtime tracking data flows.

- configure for 10 second doppler measurements

- Range data (configuration TBD by NAV)

2) RS Signal Digitizer (RSSD) for radio science. This is the new analog to digital converter for radio science. Do not use the old narrow band occultation converters (NBOC).

Simulate MGS mapping operations by taking data in five minutes segments interspersed with five minute segments of no data taking.

DSP-R configuration:
Channel 1 (XRCP)
Filter 3 (2,000 Hz)
Mode 2
True Sample Rate 5,000 Hz
12 Bit Quantization

B. Software

The GDS L1.0 software baseline is defined in "MGS GDS L1.0 Workplan"

Notes:

1) MGDS DDO V21.

2) Standard DSN operational s/w.

6.5.3 Test Participants

A. Test Engineer

GDS Engineer	Rich Benson	JPL GDS Test Engineer

B. Test Conductor

TC	Richard Southern	JPL GDS Test Conductor

C. Multimission Support

SR	Steve Rockwell	DSN Radio Science Engineer
JL	Jack Lipincott	DSN Tracking System Engineer
GG	Gene Goltz	DSN Navigation - Radiometric & Data Conditioning Team (R&DC)
HR	Herb Royden	Transmission _ _ Calibration (TSAC)
GV	Geof Vaughn	Multimission SEG
MF	Mike Fitzpatrick	MGSO System Administrator for MGS
YL	Young Lee	MGSO Data Delivery Engineer for MGS
Data Control	Tom Boreham	MGSO Data System Operations Team

D. Project GDS Support

NOPE	Dave Recce	Network Operations Project Engineer for MGS
MC	Mick Connally	Radio Science Support Team
PE	Pat Esposito	Navigation Analysis System Engineer
FS	Frank Singleton	GDS Network Engineer
JJ	Jeff Jones	JPL Science Support Engineer
SW	Steve Wissler	Planning and Sequencing subsystem engineer

E. Project/User Support

BA	Belinda Arroyo	Project Resource Scheduler
RoS	Rob Smith	Mission Control
RS	Richard Simpson	Radio Science Team
GS	Gary Smith	JPL PDB Administartion

6.5.4 Test Data

All test data for test case 5 will be generated in real time at the DSN stations in normal data acquisition modes, but without a spacecraft in view. The problem with getting real tracking data from a flying spacecraft is that we know of no s/c with an X-band uplink to give a realistic 2-way response. Simulation of radiometric data is judged to be not cost effective. Therefore, test tracking data will generally include true angle data, static doppler data, and range data which merely contains the station delay (i.e., the light time from the X-band transmitter through the attenuator to the X-band maser.) Tracking data will be formatted by the MDA as collected from the Blk V receiver.

Radio Science test signal will be derived from the exciter and test translator as described above for the tracking test.

Monitor data will normal Mon-5-15 data from the link monitor and control (LMC) and complex monitor and control (CMC) processors.

6.5.5 Test Scenario

Part 1 - Resource Planning and Allocation

In part 1, the station support needs for the six tests in the L1.0 program are identified by the GDS team and acted upon by the MOS resource scheduler. The time period for the testing is 17 November 1995, the first day that the MGSO version 21.0 system is available for project testing, through 17 February 1996, the deadline for completion. The prime pacing item is the critical spacecraft -MOS computability test is scheduled for 2 April 1996.

Testing will be nominally be on 34 meter Hi-Efficiency (HEF) stations with one test on a 70M station and one test on a 34M Beam Waveguide (BWG) station.

The new enabling technology DSN Scheduling Software is NOT included in L1.0 testing; that is not available until L1.1.

A. Preparation

1)	BArroyo	Read sample viewperiods file
2)	T C	Supply project schedule guidelines & preferences.
3)	BA	Interact with TMOD scheduling forum.
4)	BA	Verify results on DSN eight week schedule.

B. Execution

1)	BA	Verify results on DSN forecast week schedule.
2)	BA	Verify results on DSN current week schedule.
3)	BA	Verify results on DSN current week change log.
4)	BA	Produce and distribute normal products.

C. Analysis

1)	All	Compare and report discrepancies.

Part 2 - Deliver Pre-pass Products to DSN

In part 2, the normal pre-pass products are generated and delivered to the DSN. A Predicted Events File (PEF) from SEQGEN is generated and Trigger Files are generated by Nav and Radio Science users to define desired state transitions for the realtime radiometric and RS data flows.

SEG gathers the inputs, runs its process, and outputs standard products. SEF and SFOS are accepted by MCT for TBD. (do we need these?) The DSN keyword file is delivered to the DSN for station control.

Open loop receiver operator directives will be composed. These are used by the link controller to operate the DSP-R. Note that Radio Science keywords, previously used to operate the NBOC, are not active for MGS.

A. Preparation

1)	SWissler	Generate PEF. (Who provides inputs? same as triggers?)
2)	deleted	~~Generate Science SEG trigger files~~
3)	PEsposito	Generate Nav SEG trigger files.
4)	GVaughn	Generate SEF.
5)	GV	Generate SFOS.
6)	GV	Generate DSN Keywords.

B. Execution

1)	RSmith	Send DSN Keywords to DSN/NOCC.
2)	SRockwell	Send RS Ops plan to station (Twx format?)

C. Analysis

1)	RoS	Msn Cntrl: evaluate SFOS (& SEF?).

Part 3 - Configuration for the Tracking Pass

In part 3, the station and Ground Communications Facility is configured for the test.

A. Preparation

1)	DRecce	Receive keywords file

B. Execution

1)	DR	Configure metric data assembly (MDA)
2)	DR	Configure Digital Signal Processor (DSP-R)
3)	DR	Configure Link Monitor & Control processor (LMC)
4)	DR	Configure Complex Monitor & Control processor (CMC)
5)	Comm Chf	Route Mon & RS to proper GIF
6)	Comm Chf?	Check Tracking data is routed to proper gateway.

C. Analysis

1)	RoSmith	Monitor configuration progress
2)	MC, SR	Monitor configuration progress

Part 4 - Tracking Data Flow

In part 4, tracking data products are generated and delivered to the PDB, Nav team, and Radio Science Team. **Changes for L1.1 test in June 96 are shown in bold. Gene Goltz reports that changes are in the works for TRK-2-18 and TRK-2-25. It is possible to run a conversion program to create the new TRK-2-18 format; that has been done and file delivered to MGS Nav. Production s/w for TRK-2-18 and TRK-2-25 will not be ready until 8/96.**

A. Preparation

1)	done (3)	Configure metric data assembly (MDA)

B. Execution

1)	DRecce	generate TRK-2-15 blocks
2)	DR	record TRK-2-15 at station
3)	GGoltz	receive TRK-2-15 at OSCAR
4)	GG	generate ODF (TRK-2-18**) New Format: TRK-2-18 Change 1**
5)	GG	generate ATDF (TRK-2-25)
6)	GG	generate ASTD (TRK-2-28)
7)	HRoyden	generate 3 calibration files (TRK-2-21,23,24)
7a)	**Tempo**	**generate TRK-2-21, place on OSCAR.**
8)	GG	forward ODF and ASTD to ARIES
9)	**delete**	forward ODF, ATDF, 3 Calib files to NTRAN
10)	**delete**	Compose SFDUs (5 files)
11)	**delete**	store on CDB/MGFTS2 (5 files)
12)	**delete**	Pull ODF from CDB
13)	**delete**	Pull ATDF from CDB
14)	**delete**	Pull ODF, ATDF, Calib files from CDB
15)	RS	Pull ODF, ATDF, Calib files from OSCAR

C. Analysis

1)	PE	Validate products
2)	RS	Validate products

Part 5 Radio Science Data

In part 5, the radio science data products are generated and delivered to the TIS, the PDB, the Radio Science Support Team, and the Radio Science Team. **Changes in the L1.1 testing reflect first use of the DSPR remote control capabilities by multimission radio science support team and use of slave TDS at MMRS. Changes from L1.0 are shown in bold.**

A. Preparation

1)	**Sal Abbate**	Configure **remote ops workstation for** DSCC Spectrum Processor (DSP-R) **remote control**

B. Execution

1)	**M Connally**	Generate ODS (RSC-11-11)
2)	**M Connally**	Generate status, config, perf data (SCP) (RSC-11-12)
3)	**M Connally**	Generate signal spectral indicator data (SSI) (RSC-11-12)
4)	**M Connally**	record ODS
5)	**M Connally**	forward ODS as TCP-type stream (guaranteed)
6)	**M Connally**	forward SCP, SSI as IP-type stream (best effort)
7)	DSOT	Channelize SCP, forward to MMRS, RTOT
8)	DSOT	Format SSI, forward to MMRS, RTOT
9)	DSOT	Forward all SFDUs to TDS
10)	DSOT	Catalog & store SFDUs (ODS, SSI, SCP) on TDS

C. Analysis

1)	MC, RS	Verify delivery of radio science data to the TDS
1a)	**RS**	**Verify delivery of Radio Science data to the Master TDS.**
2)	MC, SR, RS	Determine completeness and fidelity of RSC-11-11 data
3)	MC	Monitor test progress through display of RSC-11-12 data

Part 6 Monitor Data

In part 6, the nominal monitor data is generated and delivered to Mission Control, Engineering Analysis, RSST, Navigation, and PDB.

A. Preparation

1)	{done in}	Configure LMC
2)	{ part 3 }	Configure CMC

B. Execution

1)	DR	Generate monitor data (MON-5-15)
2	DR	Record monitor blocks at station (SCP)
3)	DSOT	Record monitor blocks on TDS
4)	DSOT	generate monitor channels
5)	DSOT	broadcast monitor channels to EAS, MCT
6)	DSOT	Record monitor channels on TDS
7)	RTOT	Validate RT monitor data

C. Analysis

1	SCT	Validate telecom related monitor data
2)	RS, SR, MC	Validate radio science related monitor data

6.5.6 Test Success Criteria

PART 1 - Resource Planning and Allocation

1) Resource needs clearly communicated to scheduler.
2) 34 meter HEF at each DSCC scheduled.
3) 34 M BWG scheduled.
4) 70 M scheduled.

PART 2 - Deliver Predicts

1) Generate Keywords File
2) Deliver same
3) Read same
4) Keywords file called for state changes properly
   - accurate
   - effective

PART 3 - Configure the GDS

1) DSN configured correctly and on time

Part 4 - Tracking Data

1) Tracking products to PDB
2) Tracking products to Navigation Team & Radio Science Team

Part 5 - Radio Science Data

1) RS products to PDB
2) RS products to RS Support Team & Radio Science Team

Part 6 - Monitor Data

1) Monitor data to MCT
2) Monitor data to SCT
3) Monitor data to RSST & Radio Science Team
4) Monitor data to Nav
5) Monitor data to PDB

6.6 Test Case #6: Downlink Process Dataflow

Part A - SPAS & SCT

6.6.1 Test Overview

The Downlink process begins with extraction of data from the PDB, includes data analysis, and ends with preparation of products which directly feed the Uplink process. It includes maneuver planning and analysis. It excludes realtime generation and routing of telemetry, tracking, radio science and monitor data, which is covered in test cases #4 “Telemetry Dataflow” and #5 “Tracking and Radio Science Dataflow”. It also excludes systematic navigation dataflows, which are covered in test case #7 “Navigation”. Data management and administration is included in test case #8 “Mission Operations Assurance”.

A. Test Objectives

Validate NON-REALTIME project-specific dataflows, associated with spacecraft bus health monitoring, performance analysis, operations, maintenance and anomaly investigations. Also validate non-realtime dataflows associated with science instrument health monitoring, operations and science analysis.

Note: validation of realtime dataflows, associated with spacecraft bus and instrument health monitoring, is included in test case # 4 “Telemetry Dataflow”. This includes realtime processing/display of spacecraft bus engineering data by JPL-Mission Control and LMA-SCT, as well as realtime and near-realtime processing/display of instrument-packet-embedded engineering data at instrument processing sites and JPL ER workstations.

B. Test Description

The test has 11 parts:

1) SCT Subsystem Telemetry Analysis and Trending

   Retrieval of telemetry channels from PDB. Generations of lists, reports plots trends etc.

2) SCT Power Subsystem Analysis

   Generation of predicted power profiles based on sequence of events, comparison of predicts vs. actuals, generation of voltage/temperature curves.

3) SCT Thermal Subsystem Analysis

   Generation of predicted thermal profiles based on sequence of events, comparison of predicts vs. actuals.

4) SCT AACS Subsystem Analysis

Design spacecraft slews, generate attitude profiles, spacecraft momentum management, ephemeris generation, star catalog generation and updates, attitude reconstruction..

5) Propulsive Maneuver Planning and Analysis & SCT Propulsion Subsystem Analysis

Estimate mass, moments of inertia, center of gravity. Interaction between NAVT and SCT in propulsive maneuver planning and preparation. Maneuver reconstruction and analysis.

6) SCT Telecom Analysis

Generate Telecom performance predictions for SCT and DSN. Evaluate telecom link performance. Provide signal level predictions. Maintain telecom link databases.

7) SCT C&DH Analysis and Flight Software Maintenance

Processing of memory readouts, memory state tracking and comparisons, command verification analysis, SCLK/SCET file generation, distribution and validation, EDF & SCP reloads, buffer & table updates, PDS maintenance & reload, flight software & spacecraft parameter tracking

8) SCT/MC Parameter File Maintenance & Distribution

Decom, Decal, Command/Telemetry Dictionary, Block Dictionary, Flight rules maintenance, derived product generation, validation and distribution. Generation maintenance distribution and validation of telemetry alarm limits.

9) Spacecraft Simulation for Anomaly Investigation

Use of STL for spacecraft anomaly investigation. Validate interfaces between STL and other GDS components.

10) Instrument Engineering and Science Analysis.

Extract instrument packets from the PDB. Determine instrument health and status. Accept NAIF files and other MOS products from the PDB. Prepare inputs to uplink process for instrument operations.

Extract science data from instrument packets. Validate use of MOS files and tools for science analysis.

11) Radio Science Engineering and Analysis.

Extract Radio Science ODF and SSI blocks, and SCP channels from the PDB. Perform radio science operations and science analysis.

6.6.2 Test Configuration

6.6.3 Test Participants

A. Test Engineers

FH	Fred Hammer	JPL GDS
AB	Allen Bucher	LMA GDS
JJ	Jeff Jones	JPL GDS (Science Support)

B. Test Conductor

RJS	Richard Southern	JPL GDS

C. Multimission Support

TB	Tom Boreham	MGSO DSOT
YL	Young Lee	MGSO DDO

D. Project GDS Support

RO	Robin O'Brien	JPL GDS
BA	Bryan Allen	JPL GDS
FS	Frank Singleton	JPL GDS (Network)
RB	Rich Benson	JPL GDS
AB	Allen Bucher	LMA GDS
SO	Steve Odiorne	LMA GDS
RL	Rob Leonard	LMA GDS

E. Project User Support

JN	Jim Neuman	LMA SCT Chief
OS	Owen Short	LMA SCT
ED	Eileen Dukes	LMA SCT (AACS)
DE	Dwight Eckert	LMA SCT (C&DH)
DG	Dave Gingerich	LMA SCT (C&DH)
SD	Sam Dominick	LMA SCT (Propulsion)
RZ	Ray Zercher	LMA SCT (Power)
GH	Gary Holmstead	LMA SCT (Thermal)
BA	Bill Adams	LMA SCT (Telecom)
KS	Ken Starnes	LMA SCT (STL)
RS	Rich Springer	JPL MOC ER
MC	Mike Caplinger	MOC GDS
TR	Tim Reyes	MAG GDS
GE	Greg Elman	MOLA GDS
PJ	Peggy Jester	MOLA GDS
AR	Andre Ribes	MR GDS
NG	Noel Gorelick	TES GDS
JC	John Callas	TES ER
DW	Dan Winterhalter	MAG ER
MJC	Mick Connally	RS ER
RXS	Dick Simpson	RS GDS

CK	Carl Kloss	JPL SIT
PE	Pat Esposito	JPL NAVT
CW	Charles Whetsel	JPL SCT (S/C Dev)
LT	Liegh Torgerson	JPL SCT (S/C Dev)
GC	George Chen	JPL SCT (S/C Dev)

6.6.4 Test Data

TD-1	Spacecraft Bus Engineering Data on PDB
TD-2	Radio Science ODF, SSI and SCP data on PDB
TD-3	Instrument packets on PDB
TD-4	DSN Monitor data on PDB
TD-5	SCT Files on PDB
TD-6	Nav Files on PDB
TD-7	Anomaly Sequence Products
TD-8	STL Telemetry
TD-9	Decom Maps, CPT’s

6.6.5 Test Scenario

PART 1 - SCT Subsystem Telemetry Analysis and Trending

Retrieval of telemetry channels from PDB. Generations of lists, reports plots trends etc.

A. Preparation

1)	SCT	Identify telemetry list to process.
2)	SCT	Verify latest DMD binary files are available
3)	SCT	Verify latest versions of qck_trend, vmplot, and ez_query are available

B. Execution

1)	SCT	Retrieve selected telemetry data from the PDB/TDS using ez_query
2)	SCT	Execute qck_trend to trend selected channels
3)	SCT	Plot telemetry channels from query Data Return file and from qck_trend

C. Analysis

1)	SCT	Verify data returned from the query is formatted as a Data Return File (DRF)
2)	SCT	Verify execution of qck_trend and vmplot
3)	SCT	Verify selected telemetry can be printed, viewed, and edited

PART 2 - SCT Power Subsystem Analysis

Generation of predicted power profiles based on sequence of events, comparison of predicts vs. actuals, generation of voltage/temperature curves.

A. Preparation

1)	SCT	Obtain sequence Predicted Events File (PEF) from PSS
2)	SCT	Verify latest version of MGPOWER is available
3)	SCT	Verify Battery and Solar Array I/V Curve Databases are available
4)	SCT	Build operator input file for selected processing
5)	SCT	Obtain a power profile from a previous run of MGPOWER. Use it as a simulated actual power profile.

B. Execution

1)	SCT	Execute MGPOWER to generate a predicted power profile, V/T curves, and I/V curves for the selected sequence
2)	SCT	Plot predicted power profile vs simulated actual power profile using VMPLOT.

C. Analysis

1)	SCT	Verify predicted power profile represents input sequence of events
2)	SCT	Verify output V/T and I/V curves

PART 3 - SCT Thermal Subsystem Analysis

Generation of predicted thermal profiles based on sequence of events, comparison of predicts vs. actuals.

A. Preparation

1)	SCT	Obtain sequence Predicted Events File (PEF) from PSS
2)	SCT	Obtain predicted power profile from Power Subsystem
3)	SCT	Obtain attitude, S/C configuration, and orbital data from AACS
4)	SCT	Verify latest versions of TRASYS and SINDA are available

B. Execution

1)	SCT	Execute TRASYS using input AACS data to produce S/C Orientation (plot) and thermal radiation prediction
2)	SCT	Execute SINDA using above TRASYS thermal radiation predictions and power profile info to produce predicted temperatures vs time
3)	SCT	Plot predicted temperatures vs time using VMPLOT

C. Analysis

1)	SCT	Verify S/C orientation plot and thermal radiation prediction file
2)	SCT	Verify predicted temperatures vs time match input sequence, orientation, and power data
3)	SCT	Verify output of temperatures vs time are present for all desired S/C components

PART 4 - SCT AACS Subsystem Analysis

PART 4.0 SCT AACS SUBSYSTEM ANALYSIS

PART 4.1 Ephemeris Updating Process

The Ephemeris Updating Process is used to load and update the polynomial coefficients that prescribe the position of the Sun, Earth, and Mars as observed from the spacecraft. It is expected that ephemeris files will be updated every seven days in cruise and every 14 days in mapping.

A Preparation

1.	SCT	Obtain latest version of TRANS (SPAS module) including SASFGEN utility.
2.	SCT, NAV, SEQ	Obtain latest version of CDB_WOTU (Interface to Project Database)
3	SCT, NAV, SEQ	Obtain latest version of SFDU Wrap/Unwrap utilities
4.	SCT, NAV	Obtain latest version of SPACIT (SPK text/binary conversion utility)

B Execution

1.	SCT, NAV	Determine begin and end times of ephemeris
2.	NAIF	Generate Leapseconds File
3.	SCT	Place Leapseconds File on PDB and deliver File Release to NAV
4.	NAV	Generate SPK file with spacecraft and planetary ephemeris
5.	NAV	Place SPK file on PDB and deliver File Release to SCT
6.	SCT	Generate SCLK-SCET File
7.	SCT	Place SCLK-SCET File on PDB and deliver File Release
8.	SCT	Prepare TRANS input files (includes running SFDU Unwrap and SPACIT utilities)
9.	SCT	Run TRANS
10.	SCT	Wrap SASF with SFDU
11.	SCT	Use CDB_WOTU to place the wrapped SASF on the PDB & deliver File Release
12.	SEQ	Create ephemeris SCMD and deliver to STL
13.	STL	Uplink SCMD

C Analysis

1.	SCT, NAV, SEQ	Verify that the Leapseconds, SPK, SCLK-SCET, and SASF files comply with the appropriate SISs.
2.	SCT, NAV, SEQ	Verify that the appropriate software can read the generated files.
3.	SCT	Verify the TRANS Results, and TRANS Diary files
4.	STL	Verify that the SCMD can be uplinked by STL

PART 4.2 STAR Swath Catalog Updating Process

The STAR Swath Catalog Updating Process is used to load and update the Star Catalog in flight software. The Swath Catalog contains the positions of all the stars expected to be seen by the CSA over a specified period of time, given the spacecraft's spin axis orientation.

A Preparation

1.	SCT	Obtain latest version of STAR (SPAS module) including SASFGEN utility.
2.	SCT	Obtain the appropriate Star Source Catalog
3.	SCT, NAV, SEQ	Obtain latest version of CDB_WOTU (Interface to Project Database)
4.	SCT, NAV, SEQ	Obtain latest version of SFDU Wrap/Unwrap utilities
5.	SCT, NAV	Obtain latest version of SPACIT (SPK text/binary conversion utility)

B Execution

1.	SCT, NAV	Determine begin and end times of Star Swath Catalog
2.	NAIF	Generate Leapseconds File
3.	SCT	Place Leapseconds File on PDB and deliver File Release to NAV
4.	NAV	Generate SPK file with spacecraft and planetary ephemeris
5.	NAV	Place SPK file on PDB and deliver File Release to SCT
6.	SCT	Generate SCLK-SCET File
7.	SCT	Place SCLK-SCET File on PDB and deliver File Release
8.	SCT	Generate TRANS Ephemeris File
	SCT	Prepare STAR input files (includes running SFDU Unwrap and SPACIT utilities)
9.	SCT	Run STAR
10.	SCT	Wrap SASF with SFDU
11.	SCT	Use CDB_WOTU to place the wrapped SASF on the PDB & deliver File Release
12.	SEQ	Create Swath Catalog SCMD and deliver to STL
13.	STL	Uplink SCMD

C Analysis

1.	SCT, NAV, SEQ	Verify that the Leapseconds, SPK, SCLK-SCET, TRANS Ephemeris, and SASF files comply with the appropriate SISs.
2.	SCT, NAV, SEQ	Verify that the appropriate software can read the generated files.
3.	SCT	Verify the STAR Results, and STAR Diary files
4.	STL	Verify that the SCMD can be uplinked by STL

PART 4.3 Angular Momentum Desaturation Reconstruction Process

The Angular Momentum Desaturation Generation (AMDGEN) software is used to create the AMD File for the NAV Team containing a reconstruction of reaction wheel unloadings. The AMDGEN File contains the start and stop times of the desaturations, thruster pulse counts, and thruster characteristics. During cruise, an AMD File will be generated following each unloading. During Mapping, an AMD File will be generated once a week.

A Preparation

1.	SCT	Obtain latest version of AMDGEN (SPAS module).
2.	SCT	Obtain latest version of CDR to ECDR conversion and transfer utility.
3.	SCT, NAV, SEQ	Obtain latest version of CDB_WOTU (Interface to Project Database)
4.	SCT, NAV, SEQ	Obtain latest version of SFDU Wrap/Unwrap utilities
5.	?	Place an MGS CDR containing AMD relevant, simulated spacecraft telemetry on the PDB.

B Execution

1.	SCT	Generate SCLK-SCET File
2.	SCT	Place SCLK-SCET File on PDB and deliver File Release
3.	SCT	Use the CDR to ECDR conversion and transfer utility to convert the PDB resident CDR to an ECDR telemetry file resident on the SCT workstation.
4.	SCT	Prepare AMDGEN input files
5.	SCT	Run AMDGEN
6.	SCT	Wrap AMD File with SFDU
7.	SCT	Use CDB_WOTU to place the wrapped AMD File on the PDB & deliver File Release
8.	NAV	Use appropriate NAV software to read the AMD File
9.	NAV	Feedback reconstructed Delta-V to SCT

C Analysis

1.	SCT, NAV, SEQ	Verify that the, SCLK-SCET, ECDR, and AMD files comply with the appropriate SISs.
2.	SCT, NAV, SEQ	Verify that the appropriate software can read the generated files.
3.	SCT	Verify the AMDGEN Results, and AMDGEN Diary files
4.	SCT, NAV	Verify that the reconstructed Delta-V is consistent with the spacecraft telemetry

PART 5 - Propulsive Maneuver Planning/Analysis & SCT Propulsion Subsystem Analysis

Estimate mass, moments of inertia, center of gravity. Interaction between NAVT and SCT in propulsive maneuver planning and preparation. Maneuver reconstruction and analysis.

A. Preparation

1)	SCT	Obtain S/C mass properties and S/C characteristics files
2)	SCT	Obtain attitude, S/C configuration, and orbital data from AACS
3)	SCT	Verify latest version of MGPROP is available

B. Execution

1)	SCT	Execute MGPROP to produce the Maneuver Performance Data File. Deliver to NAV team.
2)	SCT	Obtain Maneuver Performance File from NAV
3)	SCT	Execute MGPROP to produce the Maneuver Implementation File. Deliver to NAV and Sequence.

C. Analysis

1)	SCT	Verify input and output file formats (According to SISs)
2)	SCT	Verify generated burn times, magnitude, and duration

PART 6 - SCT Telecom Analysis

Generate Telecom performance predictions for SCT and DSN. Evaluate telecom link performance. Provide signal level predictions. Maintain telecom link databases.

A. Preparation

1)	SCT	Verify TPAP input data files have been updated to reflect MGS configuration
2)	SCT	Obtain trajectory data from NAV
3)	SCT	Verify latest version of TPAP is available

B. Execution

1)	SCT	Execute TPAP to produce telecom performance predictions, link predictions, and predicted signal levels
2)	SCT	Update TPAP Design Control Tables
3)	SCT	Deliver Telecom Performance Predictions (SIS:EAE-019)

C. Analysis

1)	SCT	Verify input and output file formats (According to SISs)
2)	SCT	Verify output link predicts, data rates, and Design Control Tables

PART 7 - SCT C&DH Analysis and Flight S/W Maintenance

Processing of memory readouts, memory state tracking and comparisons, command verification analysis, SCLK/SCET file generation, distribution and validation, EDF & SCP reloads, buffer & table updates, PDS maintenance & reload, flight software & spacecraft parameter tracking.

A. Preparation

1)	SCT	Obtain latest SCP TFAV file
2)	SCT	Obtain latest PDS flight software
3)	SCT	Obtain LTF from NAV

B. Execution

1)	SCT	Convert SCP TFAV to an SASF using MST
2)	SCT	Convert PDS flight load to an SASF using PDSFLOAD
3)	SCT	Generate SCLK_SCET Coefficient File
4)	SCT	Deliver SCLK_SCET file to PDB
5)	SCT	Deliver SASFs to sequence
6)	SEQ	Generate SCMFs representing delivered SASFs
7)	SEQ	Deliver SCMFs to SCT
8)	SCT	Upload SCP FSW SCMF to STL
9)	SCT	Utilize CVMONITOR to verify command receipt and checksum
10)	SCT	Issue MRO command for SCP FSW update
11)	SCT	Utilize MGS VIEW to capture MRO
12)	SCT	Utilize MST COMPARE to compare MRO vs input FSW TFAV
13)	SCT	Utilize MST PTRACK to process SCMF and extract FSW and Parameter Updates

C. Analysis

1)	SCT	Verify input and output file formats (According to SISs)
2)	SCT	Verify interaction with STL and GDS components

PART 8 - SCT/MC Parameter File Maintenance & Distribution

Decom, Decal, derived product generation, validation and distribution. Generation maintenance, distribution, and validation of telemetry alarm limits.

A. Preparation

1)	SCT	Obtain latest Channel Parameter Table(CPT), Template Display Language(TDL), Channel Conversion Language(CCL), and Decom Map source files
2)	SCT	Obtain latest alarm database (CPT)

B. Execution

1)	SCT	Deliver CPT, Alarm CPT, TDL, CCL, and Decom Map source files to RTOT with required file release forms.
2)	RTOT	Compile associated products.
3)	RTOT	Provide file release form for compiled binary products.
4)	SCT	Compare compiled binary files with verified binary files currently in production.

C. Analysis

1)	SCT	Verify compiled binary files match expected file content
2)	SCT	Verify execution of DMD and TIS with new binary files.

PART 9 - Spacecraft Simulation for Anomaly Investigation

Use of STL for spacecraft anomaly investigation. Validate interfaces between STL and other GDS components.

A. Preparation

1)	SCT	Obtain S/C sequence SCMF, RPEF, and ISOE from sequence
2)	SCT	Verify flight software version and STL configuration is capable of supporting target sequence.

B. Execution

1)	SCT	Upload sequence to STL.
2)	SCT	Verify sequence execution vs RPEF and ISOE
3)	SCT	Inject anomaly that causes Safe Mode

C. Analysis

1)	SCT	Verify command and telemetry paths to/from STL and the SCT MSA
2)	SCT	Verify sequence execution vs RPEF and ISOE
3)	SCT	Verify data receipt following anomaly injection

PART 10 - Instrument Engineering and Science Analysis

The ability to store and retrieve information from the PDB, sequence generation of non-interactive payload commands, receipt of instrument packets and, receiving science data from engineering packets from science workstations, SOPCs and ERCs, will be tested during this test. The testing will start on December 1, 1995.

Activities will be as follows:

1) Personnel from the project user support area will generate a sequence and store it, and the resulting spacecraft command file, on the file storage portion on the PDB (a.k.a. CDB). The SCMF will be generated and the files will be stored by using the NIPC process.
2) The TDS (stream data storage portion of the PDB) will be queried for instrument packets. Project user support personnel will verify receipt of the data.
3) The TDS will be queried for science data (I-channels) from engineering packets. The data shall be verified by using DMD.
4) Project user support personnel will copy files from the CDB.

A. Preparation

1)	MF	Configure mgtes, mgmola, mger3 and, mgsost to L1.0
2)	JJ	Coordinate with MOLA the generation of an SASF
3)	JJ	Coordinate with TES the generation of an SASF
4)	JJ	Acquire MO S&E data frames that contains instrument packets for MOLA and TES
5)	JJ	Characterize the data
6)	DO	Coordinate the loading of MO data in the TDS (ensure no conflict with the MGS S&E data)
7)	PE	Acquire NAV files; S&P Kernels and Light Time File
8)	JJ	Populate database with NAV files
9)	JJ	Schedule the NIPC workstation & support

Day of test:

1)	DO	Load the TDS with MO S&E data

B. Execution

1)	GE/PJ	Have MOLA personnel access the NIPC process (can be ran whenever the NIPC workstation is available)
2)	BB	Have MOLA ER personnel access the NIPC process (can be ran whenever the NIPC workstation is available)
3)	NG	Have TES personnel access the NIPC process (can be ran whenever the NIPC workstation is available)
4)	JC	Have TES ER personnel access the NIPC process (can be ran whenever the NIPC workstation is available)
5)	GE/PJ	Have the MOLA personnel query the database for I-channels (from engineering data)
6)	BB	Have the MOLA ER personnel query the database for I-channels (from engineering data)
7)	NG	Have the TES personnel query the database for I-channels (from engineering data)
8)	JC	Have the TES ER personnel query the database for I-channels (from engineering data)
9)	GE/PJ	Have the MOLA personnel query the database for Instrument packets
10)	BB	Have the MOLA ER personnel query the database for Instrument packets
11)	NG	Have the TES personnel query the database for Instrument packets
12)	JC	Have the TES ER personnel query the database for Instrument packets
13)	GE/PJ	Have the MOLA personnel get NAV files from the database (can be ran without support of the TDS; only support needed is JJ & GE/PJ)
14)	BB	Have the MOLA ER personnel get NAV files from the database (can be ran without support of the 15)TDS; only support needed is JJ & BB)
16)	NG	Have the TES personnel get NAV files from the database (can be ran without support of the TDS; only support needed is JJ & NG)
17)	JC	Have the TES ER personnel get NAV files from the database (can be ran without support of the TDS; only support needed is JJ & JC)

C. Analysis

1)	JJ	Check database for SCMF
2)	GE/PJ	Compare I-channels received are as expected
3)	BB	Compare I-channels received are as expected
4)	NG	Compare I-channels received are as expected
5)	JC	Compare I-channels received are as expected
6)	GE/PJ	Compare instrument packets received are as expected
7)	BB	Compare instrument packets received are as expected
8)	NG	Compare instrument packets received are as expected
9)	JC	Compare instrument packets received are as expected
10)	GE/PJ and BB	Compare results
11)	NG and JC	Compare results

PART 11 - Radio Science Engineering and Analysis

The ability to store and retrieve radio science information from the PDB from radio science workstations, SOPC and ERC, will be tested during this test. The testing will be performed between December 1, 1995 and February 17, 1996.

Activities will be as follows:

1) The TDS (stream data storage portion of the PDB) will be queried for Radio Science Data (as per RSC-11-11).
2) The TDS will be queried for monitor data(as per RSC-11-12).
3) Project user support personnel will copy files from the CDB.

A. Preparation

1)	MF	Configure mgtes, mgmola, mger3 and, mgsost to L1.0
2)	RB	Acquire RS data frames; RSC-11-11 and RSC-11-12 (as per test case #5)
3)	RB	Characterize the data
4)	RB	Coordinate the loading of MO data in the TDS
5)	JJ	Populate database with NAV files (from test case #6, step 10)

B. Execution

1)	RS	Have the RS personnel query the database for I-channels (from engineering data)
2)	MC	Have the RS ER personnel query the database stream data
3)	RS	Have the RS personnel get NAV files from the database (can be ran without support of the TDS; only support needed is JJ & RJS)
4)	MC	Have the RS ER personnel get NAV files from the database (can be ran without support of the TDS; only support needed is JJ & MC)

C. Analysis

1)	JJ	Check database for SCMF
2)	RJS	Compare instrument packets received are as expected
3)	MC	Compare instrument packets received are as expected
4)	RJS and MC	Compare results

6.6.6 Test Success Criteria

PART 1 - SCT Subsystem Telemetry Analysis and Trending

1) Verify query results are formatted as a Data Return File
2) Verify SPAS programs, qck_trend and vmplot can process ez_query produced Data Return Files

PART 2 - SCT Power Subsystem Analysis

1) Verify MGPOWER can process an input PEF from the Sequence Subsystem
2) Verify VMPLOT can plot actual vs predicted power profiles

PART 3 - SCT Thermal Subsystem Analysis

1) Verify Thermal engineers obtain desired information from AACS and Power
2) Verify predicted temperatures vs time match input sequence, orientation, and power date
3) Verify output of temperatures vs time are present for all desired components

PART 4 - SCT AACS Subsystem Analysis

1) Verify that the Leapseconds, SPK, SCLK-SCET, and SASF files comply with the appropriate SISs.
2) Verify that the appropriate software can read the generated files.
3) Verify the TRANS Results, and TRANS Diary files
4) Verify that the SCMD can be uplinked by STL
5) Verify that the Leapseconds, SPK, SCLK-SCET, TRANS Ephemeris, and SASF files comply with the appropriate SISs.
6) Verify that the appropriate software can read the generated files.
7) Verify the STAR Results, and STAR Diary files
8) Verify that the SCMD can be uplinked by STL
9) Verify that the, SCLK-SCET, ECDR, and AMD files comply with the appropriate SISs.
10) Verify that the appropriate software can read the generated files
11) Verify the AMDGEN Results, and AMDGEN Diary files
12) Verify that the reconstructed Delta-V is consistent with the spacecraft telemetry

PART 5 - Propulsive Maneuver Planning/Analysis & SCT Propulsion Subsystem Analysis

1) Verify input and output file formats
2) Verify computed burn times, magnitude, and duration

PART 6 - SCT Telecom Analysis

1) Verify format of output telecom predicts

PART 7 - SCT C&DH Analysis and Flight S/W Maintenance

1) Verify all input and output file formats
2) Verify output SCMF matches input SCP and PDS load files
3) Verify MRO and compare process
4) Verify SCLKSCET file generation and delivery process
5) Verify Parameter tracking process

PART 8 - SCT/MC Parameter File Maintenance & Distribution

1) Verify file delivery process with MCT
2) Verify MCT compilation and distribution of binary files

PART 9 - Spacecraft Simulation for Anomaly Investigation

1) Verify MOS-to-STL interaction
2) Verify SCMF, RPEF, and ISOE interface to STL
3) Verify STL data flows

PART 10 - Instrument Engineering and Science Analysis

1) SCMFs generated as expected
2) SASFs and SCMFs stored on the CDB
3) I- channels received as expected
4) Instrument packets received as expected
5) NAV files copied to the SOPCs
6) SOPC and ER workstation receive same results

PART 11 - Radio Science Engineering and Analysis

1) Radio science data as received as characterize
2) NAV files copied to the SOPCs
3) SOPC and ER workstation receive same results

Part 6B Downlink Dataflow (End-to-End)

PART 1 - Automated Operations Logging Tool (OLOG)

A. Preparation

Verify that OLOG is installed on the test workstation along with its MGS configuration files and MAN pages.

B. Execution

The following test cases are designed to test the User initial conditions to verify the program can be configured to support the needs of individual project.

Step 1 Automatic logging of specified spacecraft Telemetry.

Verify that the program can automatically log the user specified downlink telemetry.

Step 2 Automatic logging of telemetry can be used at the same time as the user is making entries using the pull down menu entries.

Verify that the program can automatically log the user specified downlink telemetry at the same time as the user is entering log data via the pull down menus.

Step 3 Enter a group of specified channels to the log.

The values of specified telemetry are entered into the log upon request of the user. Also, verify that the program can automatically log the red alarms observed in the spacecraft telemetry.

Step 4 Manual Entry and editing of entries.

Commanding is performed by the user. The "olog" tool is then used to log this commanding activity which includes normal radiation, suspends, and aborts.

Step 5 Manual Entry and editing of entries.

Procedures: The user makes entries into the operations log using both pull down menus and by typing in the test. In Addition, the cut and paste feature of Xwindows is used to enter text. Edits are made to the log, and it is then checked for accuracy.

Step 6 Start of shift and end of shift handover page.

The user generates a start of shift page with all so that all the fields contain an entry. The same is done for the end of shift page. The pages are checked to assure that there is a place for all required information.

Step 7 Viewing the logged data.

All data in the log is selected to be viewed. The data is viewed within a specified time period. The data is viewed based on a specific SC. The data is viewed based on a specific STN/SYS field entry.

Step 8 Printing the logged data.

All data in the log is selected to be printed. The data is printed within a specified time period. The data is printed based on a specific SC. The data is printed based on a specific STN/SYS field entry.

B. Analysis

Each test case will contain a detailed description of all expected program inputs. These outputs will include the program generated operations log to include the handover sheets. The log information can be displayed to the screen or directed to printer output. Both shall be checked for completeness and accuracy.

PART 2 - Remote Telemetry Access

A. Preparation

B. Execution

C. Analysis

PART 3 - Data Management

Objective - demo that both sides of PDB are managed sufficient to support launch and cruise operations.

Prep

none. Data resides in TDS and CDB based on other test case flows.

Execution

1. Data Admin Backup and restore CDB files
2. Data Admin Produce a cruise Level 0 archive volume; send to SCT

Analysis

1. SCT Read Level 0 CD-ROM; report (after 8/15/96)
   - engr channels
   - ETF frames
   - monitor channels
   - monitor records

notes:
• Writing across partitions was demo'd by Y. Lee as part of TCDM 21.1.
• TDS backup and restore are too low-level for GDS Test
• Measure and report TDS space availability (DSOT/admin coord): encounter item
• Science Level 0 product is encounter item
• E kernel is encounter item

6.7 Test Case #7: Navigation Data Flow

6.7.1 Test Overview

A. Test Objectives

Demonstrate, test and validate end-to-end navigation product data flow as shall be required for MOS Compatibility tests and MGS flight operations.

B. Test Description

This test is divided into two parts:

1) Interplanetary phase navigation data flow,

2) Aerobraking phase navigation data flow.

3) Special Software Tests -- Mars Observer Tracking Data Analysis Test.

During both of these phases, Navigation shall generate all products required by other operations teams. Products shall be delivered to the PDB (SFDU wrapped) and the DSN-interface OSCAR for P-files. All teams requiring these products (files) shall transfer them into their sub-systems or operations hardware. These products shall be read by the receiver's software and it shall be verified that the navigation products have been successively utilized. Confirmation of this shall be delivered back to the Navigation Team by e-mail.

The primary date for this test shall be **12/5/95** with a backup date on 1/9/96.

6.7.2 Test Configuration

A. Hardware/Network

An overview of the Navigation hardware to be utilized during this test and the networking is given in Fig. 7.1. The navigation computers are in the Navigation Computing Facility (NCF; Ares and Tharsis) and the workstations are in Bldg 264, 2nd floor as shown.

B. Software

The software baseline used in this test is given in the MGS GDS L1.0 Workplan by F. Singleton. An overview of the navigation software and its utilization with both input and output files is given in Fig. 7.2

6.7.3 Test Participants

A. Test Engineers

PBE	P. Esposito	JPL GDS
JEE	J. Ekelund	JPL GDS
EG	E. Graat	JPL GDS

B. Test Conductor

RJS	Richard Southern	JPL GDS

C. Multimission Support

MF	Miks Fitzpatrick	MGSO SA Lead
YL	Young Lee	MGSO DDO Engineer

D. Project GDS Support

AB	Allen Bucher	LMA GDS (SCT Development)
SW	Steve Wissler	GDS SEQ
SO	Steve Odiorne	LMA SPAS
JJ	Jeff Jones	JPL Science Support

E. Project User Support

BB	R. Brooks	JPL PST
WS	W. Sidney	JPL MPT
JN	Jim Neuman	LMA SCT
BA	Belinda Arroyo	JPL Project Resource Scheduler (PRS)
GS	Gary Smith	JPL PDB Administration
GG	Gene Goltz	JPL RMDCT Lead
		DSNOT (DSN Predicts)

6.7.4 Test Data

The test data shall be generated from a simulated interplanetary phase trajectory and an aerobraking series of orbits (orbital period is 3 hours). These correspond to the first launch date, 11/5/96. The navigation products generated from this simulation with the intended users are as follows:

Phase	Product / File	User
INTERPLANETARY	P-FILE	DSNOT, PRS
	SPK FILE	SCT, SCI
	LT FILE	SCT, SEQ, SCI
	STATRJ FILE	SCT
	MANEUVER PROFILE FILES (UPDATE)	SCT
AEROBRAKING	P-FILE	DSNOT, PRS
	SPK FILE	SCT, SCI
	LT FILE	SCT, SEQ, SCI
	OPTG FILE (UPDATE)	SCT, SEQ, SCI, MPT
	ORBIT NUMBER FILE	SCI
	STATRJ FILE	SCT
	MANEUVER PROFILE FILE (UPDATE)	SCT

6.7.5 Test Scenario

PART I Interplanetary Phase

A. Preparation (to be completed at least 48 hours prior to test execution)

1) Create simulated orbit data file, if required.
2) Create or know where to access files with parameters needed for the analysis. This includes: planet ephemeris; GIN lock file; GIN namelist inputs.
3) Have a set of scripts, or a procedure, available which can be used (with perhaps slight modifications) for the test.

B. Execution

1) Generate NAV deliverable files by running DPTRAJ. These include:
   a) P-file (an SPK file is generated with NAIF software later)
   b) Light-time file
   c) Station Polynomial file (geocentric)
2) ftp the P-file to OSCAR for pick-up by the DSN.
3) ftp the files from the NAV computer (Ares, HP 750) to one of the Sun workstations on the OPS LAN. All of the rest of the work will be done on the Sun workstations.
4) Create an SPK file.
5) SFDU wrap the NAV files (SPK, light time, station polynomial)
6) Put the NAV files onto the PDB.
7) Retrieve the NAV files from the PDB.
8) Unwrap the NAV files retrieved from the PDB.
9) Compare the unwrapped NAV files with the original NAV files.
10) Clean up any unnecessary files and directories (e.g. duplicate files on two different systems, temporary work files, etc.).
11) Notify the DSN of the name and location of the P-file on OSCAR.
12) Notify the respective teams of the names of the NAV files on the PDB.

C. Results

1) Document any problems encountered.
2) Write Failure Reports for the appropriate problems.
3) Make sure that feedback is gotten from the other teams on their ability to retrieve and use the files that NAV delivered.
4) Write a "test report": summarize results, problems and successes of test.

PART II Special Software Tests -- Mars Observer Tracking Data Analysis Test

A) Test Description:

Fit 330 days of X/X F2 & SRA data over the Mars Observer interplanetary cruise phase.

5366 X/X F2 points fit. 5658 X/X SRA points fit.

94 estimated parameters including the S/C state, AMDs, nongravitational accelerations, SRP, and range biases.

24 considered parameters including station locations, planetary ephemeris and the GMs of the Earth, Mars and the Moon.

DPTRAJ-ODP links executed: gindrive, gindump, pvdrive, twist, translate, regres accume, solve, mapgen, mapsem, output

B) Test Cases:

Nominal: Mars Observer Regression Test using the L1.0 NAV software.

Test A: Mars Observer Regression Test using the L1.1 NAV software.

Test B: Mars Observer Regression Test using the L1.1 NAV software. "Sky-Frequency" ODF used.

Test C: Mars Observer Regression Test using the L1.1 NAV software. "Sky-Frequency" ODF used. MO era EOP file used.

C) Test Results:

Mars Arrival B-Plane MME of Date

	BDOTR (km)	BDOTT (km)	TCA (ET)
Nominal	-.8398578086889566D+04	.7625873733270055D+01	20:41:04.9755
Test A	-.8398578086889566D+04	.7625873733270055D+01	20:41:04.9755
Test B	-.8398578086889566D+04	.7625873733270055D+01	20:41:04.9755
Test C	-.8398578230907170D+04	.7625992397252503D+01	20:41:04.9756

	Data SOS	Max. F2 Residual	Max. SRA Residual
Nominal	6.16430254D+02	-1.029713E-02	-8.514266E+01
Test A	6.16430247D+02	-1.029713E-02	-8.514266E+01
Test B	6.16430247D+02	-1.029713E-02	-8.514266E+01
Test C	6.32604286D+02	-1.020600E-02	-8.342049E+01

6.7.6 Test Success Criteria

PART I - Baseline Product / File Flow

1) Navigation simulates and generates all files,

2) All files are SFDU wrapped and transferred to the PDB (exception is P-file),

3) Each team / person requiring that product / file retrieves it from the PDB, transfers it to their hardware / workstation and utilizes it in their software,

4) Each team / person reports on the status of the above operation.

6.8 Test Case #8: Mission Operations Assurance

6.8.1 Test Overview

A. Test Objectives

Validate the change management process and dataflows associated with the Change Management Systems for configuration management of software code, hardware, and documentation. This validation will include remote access for MGS personnel at Denver and Science Sites. These systems include; (1) the Electronic Change Request Management system **(ECMS)** for tracking and validating change requests to configuration controlled baselines, (2) the Problem Reporting Management system (**S&MAIS**) for tracking of all Problem Reports (PR's), Incident Surprise Anomalies (ISA's), Problem Failure Reports (PFR's) and Discrepancy Reports (DR's), (3) and the Code Delivery Management system (**CDMS**) for managing changes to the software baseline. This test will be in conjunction with GDS A1.0 and GDS A1.1 testing.

B. Test Description

Test case #8 will validate the electronic change management process and dataflow for the Electronic Change Management System, the Problem Reporting System, and the Code Delivery Management System. The following tasks will be performed at remote locations and JPL in Test Case #8:

1. ECMS

1) Originate Change Requests (CR) and submit for action electronically.

2) Locate all CRs with status information.

3) Electronic notification of action and information automatically.

4) On-line Impact Assessment Report.

5) Print capability for CRs and related information in database.

6) Attachment tracking.

7) Closure of CRs.

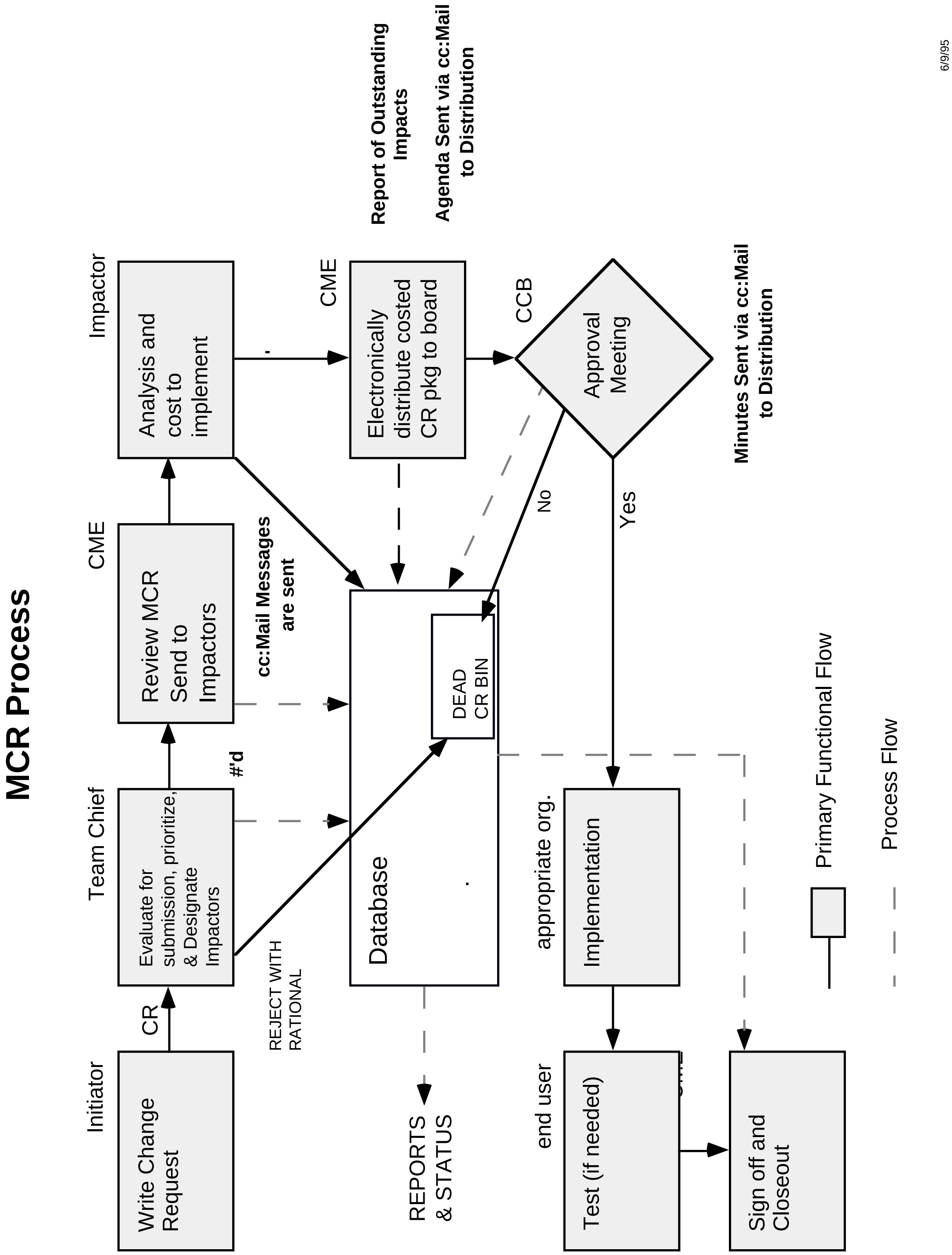


Figure 4 - MCR Process

2. S&MAIS

1) Originate FR and ISA documents using the WEB search Engine called the Document locator.

2) Originate and submit new FRs. and ISAs for processing.

3) Update existing FRs. and ISAs.

4) Closure of FRs. and ISAs.

5) Route electronically Action and Information Notification Automatically.

6) Print FR and ISA documents.

7) Print lists and abstract summaries of retrieved documents.

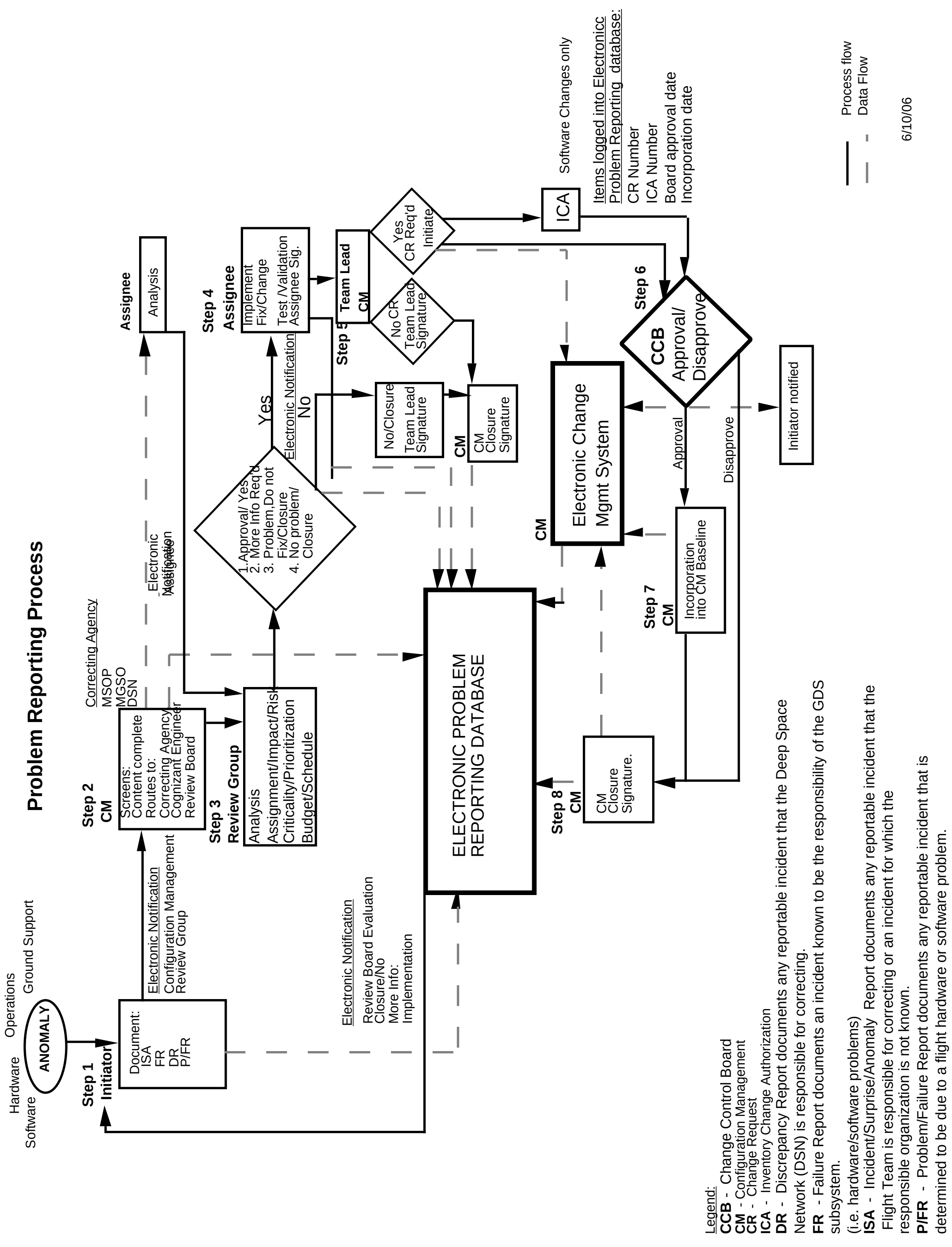


Figure 5 - Problem Reporting System

3. CDMS

The MGS Code Delivery Management System consists of the following:

1) Delivery to Staging and Engineering area.
2) Staging and delivery copy to CM area.
3) Backup CM Copy.
4) Reload current or previous delivery to CM.
5) Auditing installed program base on Workstations.
6) Standard phase modification.

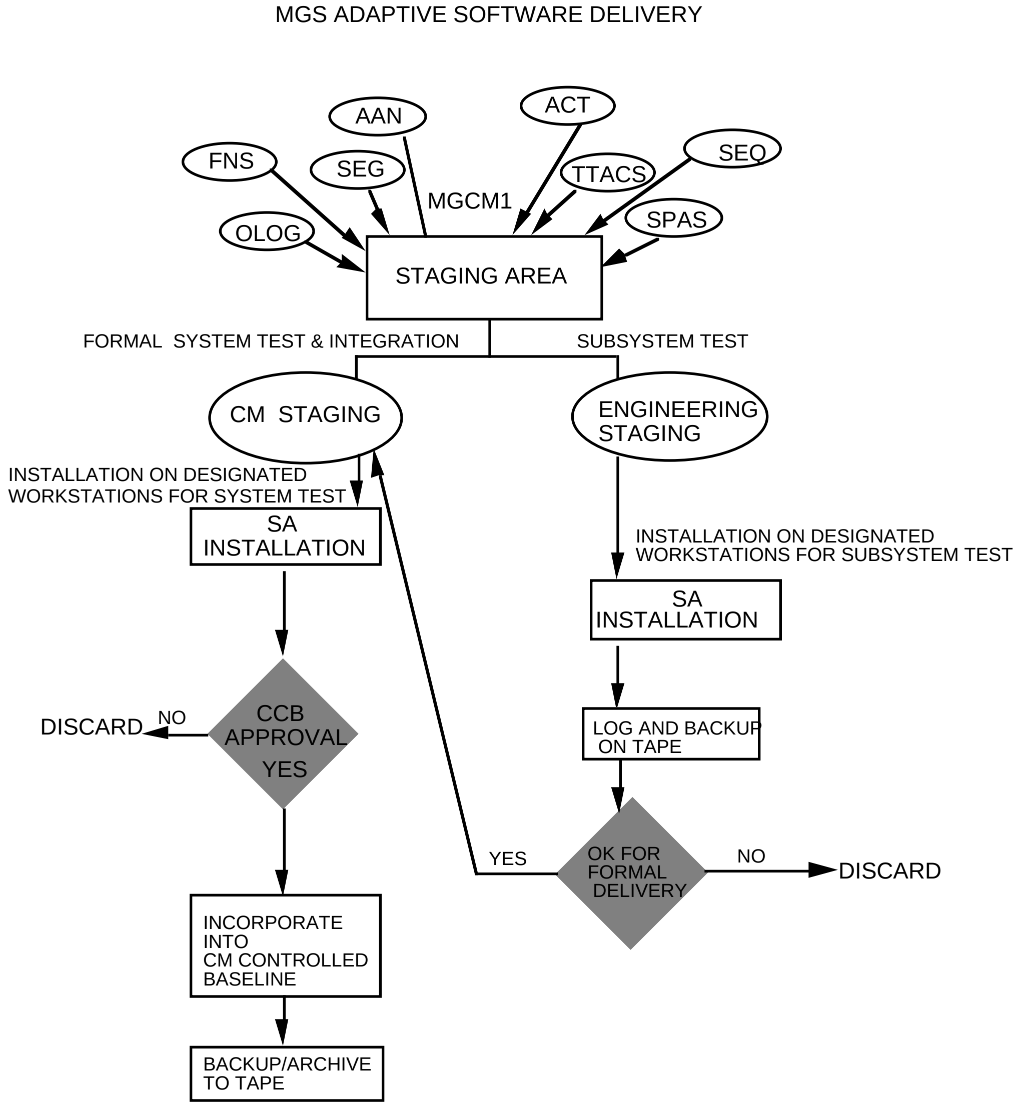


Figure 6 - Adaptive Software Delivery

6.8.2 Test Configuration

A. Hardware/Network

1. ECMS

The standard PC and Macintosh hardware configurations will be used for this test. No special configuration is necessary. The PC's and Macintosh' s will be connected to the Olympus/Elyisum server through Novell.

2. S&MAIS

The standard PC, Macintosh and UNIX hardware configurations will be used for this test. The systems will be connected through Novell using the internet Home page capability.

3. CDMS

The standard SUN SPARC IPC hardware will be used for this test. The workstation will connect to all the related workstations through TCP/IP.

B. Software

1. ECMS

The operating system will be either Windows or Macintosh platforms. The Electronic Change Management system uses Foxpro as the database management program.

2. S&MAIS

This system is not platform dependant. It uses the Word Wide Web as the front end interface. Netscape will link to the internet.

3. CDMS

The operating system is UNIX and the system was written in Bourne shell script. It resides on the flight lan.

6.8.3 Test Participants

A. Test Engineers

TC Richard Southern JPL GDS Test Engineer

B. Test Case Conductor

TC Richard Southern JPL GDS Test Engineer

C. Multimission Support

SA Mike Fitzpatrick

D. Project GDS Support

Joy Bottenfield	MSOP CM Engineer
William Zhang	MSOP CM Engineer
Leonard Tyler	Principal Investigator
Allen Bucher	LMA GDS Engineer

6.8.4 Test Data

1. ECMS

   The Test data will be the output generated from the Customer-Oriented Management Information System (CMIS V3.30) database.

2. S&MAIS

   The Test data will be the output generated from the Safety and Mission Assurance Information Systems (S&MAIS V 1.0) database.

3. CDMS

   AAN Program Set
   ACT Program Set
   FNS Program Set
   OLOG Program Set
   SEG Program Set
   SPAS Program Set
   TTAC Program Set

6.8.5 Test Scenario

A. Preparation

1. ECMS

   a. CME Verify access to system.

2. S&MAIS

   a. CME Verify access to WEB site.

3. CDMS

   a. CME Verify test data available for delivery to Staging and Engineering area.

B. Execution

1. ECMS

   Startup:

   a. To originate a Change Request:

1) TC Log into ECMS system
2) TC To create a CR press the blue plus icon in the CR selection screen. A blank CR Detail screen will display.
3) TC Complete the electronic form as appropriate. When finishe click on exit door and result will prompt to save the work in progress.
4) TC To submit for acceptance, click the submit button (hand placing a file in a basket). The status of the CR will change to submitted.

b. To locate All CRs with status information:

1) TC To view or edit an existing CR, select it in the Change Request Selection Screen which lists all existing CRs along with the status.
2) TC Press the CR Detail button or double click the item highlighted on the list of CRs. The change request detail screen displays detail information on the CR.

c. Electronic Notification of action and information automatically.

1) CME Three special buttons are provided for team chiefs, managers, and configuration managers to enable them to perform their job of CR acceptance.
2) TC To accept a draft CR and elevate to the next level, click on green traffic signal. Status will change to TC OK and the Manager and CM will be notified electronically.
3) TC The red traffic signal is used to reject a draft. Click on this button will stop the CR process. The staus for the CR will be changed to closed.

4) TC Click the 180 degree turn button to send the draft CR back to its originator for rework. The originator is notified electronically.

d. On-line impact assessment Report.

1) TC Select assessors, CM must alert the assessors to complete their assessments on-line.
2) TC To complete the assessment form, press the assessment button at the bottom of the change request selection screen. The assessment selection locator screen displays. This is a display only screen.
3) TC To save press the exit door. The assessment remains in draft.
4) TC To submit for acceptance press the submit button (hand placing a file in a basket).

e. Print capability for CRs and related Information in database.

1) TC To print a CR from either the Change Request Detail or Description screens, pull down the File menu and select Print. A change request form will print.

2) TC To print an assessment from the Assessment Detail Impact, Facilities, or Implementation screens, pull down the file menu and select print. An Assessment form will print.

3) TC To print CCB information from the CCB screen, pull down the file menu and select print. The entire CR will print.

f. Attachment Tracking

1) TC Documents button- To enter or view a list of document associated with the CR. Notes button- to enter/view a information associated with the CR. Attachments button- To enter/view to point to where any pertinent information/data is stored.

g. Closure of CRs

1) TC Press reject button(Red traffic light). This will close a CR.

2) TC When CR work is complete, CM marks the CR status Approved, Rejected, Rescheduled, or Canceled status changes to closed.

2. S&MAIS

Startup:

3. CDMS

a. Delivery to the Staging and Engineering area.

Startup:

1. TC Electronic mail Notification to CM of delivery intent
2. CME Assign a standard phase name for delivery
2. TC Log into mgscm1 designated cm staging area.
3. TC Deliver tar file to staging CM /Engineering area
4. CME Log into CM menu, click log file to verify changes.

* Mail notification is on a 24hr checking base, therefore you will have to wait 24 hours to get the change message through mail notification.

The system will verify if the program set delivery follows the CM procedure, i.e., if the delivery was not delivered in a standard phase format, it will inform the CM engineer and wait for a response.

b. Staging delivery copy to CM area.

1. CME When delivery has CCB approval, the CME will copy the Program sets from the CM staging area to the corresponding CM baseline area with the same standard phase name as the directory name.

2. CME Notify SA for installation on designated workstations.

3. SA Install Program sets on designated workstations based on Readme installation file provided by delivery engineer.

4. SA Notification to CM of installation on designated workstations.

5. CME Notification to delivery engineer of completed installation.

The system has the flexibility to adjust itself to any number of program sets that need to be copied to the CM area.

c. Archive Backup of CM controlled baseline

1. CME Label backup tape with delivery phase name
2. CME Backup CM baseline for archive storage

d. Auditing

This area is under construction and will not be operational for the A1.0 delivery.

e. Standard Phase Modification

There will be only one phase at a time to all program sets in the on-line CM staging area. CM will assign the phase to a delivery. The staging area will then be modified to reflect the assigned current delivery phase.

6.8.6. Test Success Criteria

1. ECMS

2. S&MAIS

The systems must be able to accomplish the following functions:

a. Origination/edit/update of a change management form.

b. Locate forms and information relating to the form.

c. Provide electronic action notification.

e. Monitor and track change management for hardware, software, documentation.

f. Provide status and reports.

3. CDMS

The system must be able to accomplish the following functions:

a. Monitoring the delivery routinely

b. Copy the delivery from Staging to CM Baseline

c. Backup the delivery with phase name

e. Audit the program set installation

f. Standard phase modification.

6.9 Test Case #9: Launch Operations Dataflow

6.9.1 Overview

During launch operations telemetry data will originate at KSC from the MGS spacecraft but will have two alternate paths back to JPL. The telemetry data will be processed by the TTACS system at KSC and stored on a TDS at KSC. MGS workstations at JPL and LMA will be able to access the data both in realtime and at the KSC TDS. Additionally, data will be processed through MIL-71 in realtime during RF testing with MIL-71 and returned to JPL via a separate path. Also, two equipment configurations will be used at KSC, one during PHSF operations, and one during SLC-17 launch pad operations. Dataflow for both configurations needs to verified.

For a brief period after launch ATLO personnel at KSC will need to access telemetry data from the spacecraft being returned via the tracking stations. This data flow from the JPL TDS to the KSC TDS workstations will also be tested.

Also, during launch operations, commanding of the spacecraft will be done mainly from the ATLO workstations at KSC. However, during DSN Compatiblility testing, commanding of the spacecraft will be done from the SCT RTO workstations at LMA, Denver. Both commanding paths will be tested.

A. Test Objectives

Exercise and validate the data flows that will be used by JPL and Lockheed-Martin Astronautics (LMA) for MGS Launch Operations (with Spacecraft at KSC). Specific objectives for this test are contained in section 6.9.6. This test (with appropriate variations) will be conducted only while the equipment is at KSC for launch operations. Interconnections with the MGS spacecraft have been verified by Test Case #1 and will not be retested in this test. This series of dataflow tests will verify the dataflows at KSC and with other sites during launch operations at KSC. Most of this testing can be done using either stored data or test equipment in place of the spacecraft to verify the data flows.

B. Test Description

The test has 4 parts:

1) PHSF Operations Dataflow

Validate downlink and uplink dataflows with LMA ATLO personnel at KSC, SCT personnel at JPL, SCT personnel at LMA, Denver, and SIT personnel (from SOPC's). This part of the test is run when the ATLO workstations are located in the PHSF MOSB.

a) Validate downlink dataflows with LMA ATLO personnel, SCT and SIT's (from SOPC's). Downlink is routed in real-time to KSC ATLO workstations, in near-realtime to JPL workstations, LMA SCT workstations, SOPC's, Instrument BCE's. For this test case, test equipment is used to simulate the spacecraft.

b) Validate uplink dataflows with LMA ATLO personnel, SCT and SIT's (from SOPC's and BCE's) supplying uplink inputs. For this test case, test equipment is used to simulate the spacecraft.

2) SLC-17 Operations Dataflow

Validate downlink and uplink dataflows with LMA ATLO personnel at KSC, SCT personnel at JPL, SCT at LMA, Denver, and SIT (from SOPC's). This part of the test is run when the spacecraft interface unit is in the SLC-17 Blockhouse and the ATLO workstations are located in the Building AE.

a) Validate downlink dataflows with LMA ATLO personnel, SCT and SIT's (from SOPC's). Downlink is routed in real-time to KSC ATLO workstations, in near-realtime to JPL workstations, LMA SCT workstations, SOPC's, Instrument BCE's. For this test case, test equipment is used to simulate the spacecraft.

b) Validate uplink dataflows with LMA ATLO personnel, SCT and SIT's (from SOPC's and BCE's) supplying uplink inputs. For this test case, test equipment is used to simulate the spacecraft.

3) Post-Launch KSC Operations Dataflow

Validates telemetry dataflow from the JPL TDS to ATLO personnel at KSC. This part of the test is run when the ATLO workstations are located in the Building AE.

4) MIL-71 Operations Dataflow

Validate command, telemetry, and monitor dataflows with MIL-71. This part of the test is run when the ATLO workstations are located in the PHSF MOSB.

6.9.2 Test Configuration

A. Hardware/Network

Figure 6.9-1 depicts the GDS KSC (Part I) Dataflow during PHSF operations. Figure 6.9-2 depicts the GDS KSC (Part II) Dataflow during SLC-17 operations. Figure 6.9-3 depicts the GDS KSC (Part III) Dataflow during post launch operations. Figure 6.9-4 depicts the GDS KSC (Part IV) Dataflow during PHSF operations with MIL-71.

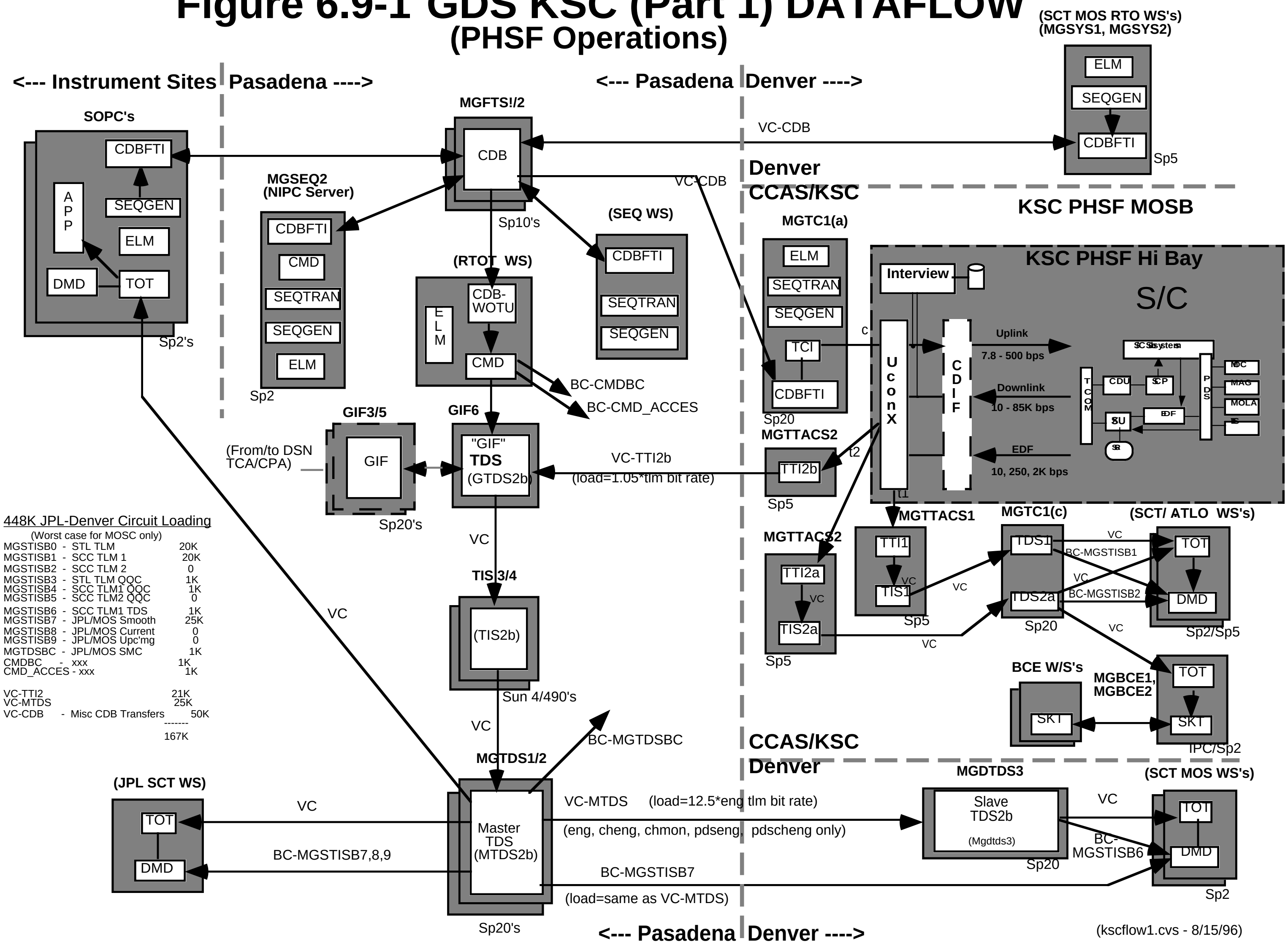
Notes:

1) The "Interview" is a Telenex dual port, serial (RS-449) data stream analyzer. It can be used for data/lead monitoring, data capture-replay, data generation (including transfer to/from Unix environment).

B. Software

The GDS A1.0 software baseline is defined in the MGS GDS A1.0 Release Description Document.

Figure 6.9-1 GDS KSC (Part 1) DATAFLOW
(PHSF Operations)



448K JPL-Denver Circuit Loading

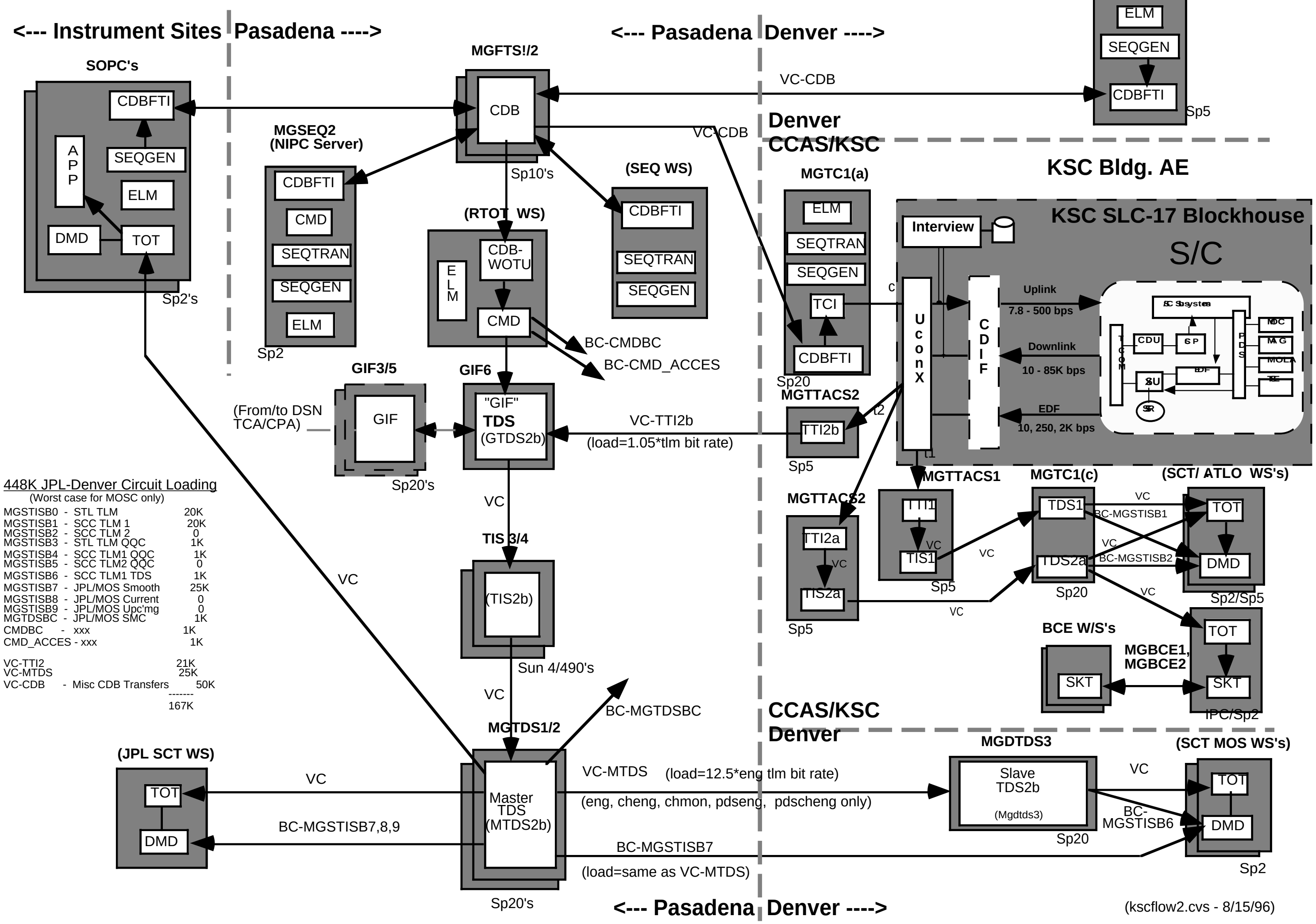
(Worst case for MOSC only)

MGSTISB0	- STL TLM	20K
MGSTISB1	- SCC TLM 1	20K
MGSTISB2	- SCC TLM 2	0
MGSTISB3	- STL TLM QQC	1K
MGSTISB4	- SCC TLM1 QQC	1K
MGSTISB5	- SCC TLM2 QQC	0
MGSTISB6	- SCC TLM1 TDS	1K
MGSTISB7	- JPL/MOS Smooth	25K
MGSTISB8	- JPL/MOS Current	0
MGSTISB9	- JPL/MOS Upc'mg	0
MGTDSBC	- JPL/MOS SMC	1K
CMDBC	- xxx	1K
CMD_ACCES	- xxx	1K
VC-TTI2		21K
VC-MTDS		25K
VC-CDB	- Misc CDB Transfers	50K

		167K

Figure 6.9-2 GDS KSC (Part 2) DATAFLOW

(SLC-17 Operations)



448K JPL-Denver Circuit Loading
(Worst case for MOSC only)

MGSTISB0	- STL TLM	20K
MGSTISB1	- SCC TLM 1	20K
MGSTISB2	- SCC TLM 2	0
MGSTISB3	- STL TLM QQC	1K
MGSTISB4	- SCC TLM1 QQC	1K
MGSTISB5	- SCC TLM2 QQC	0
MGSTISB6	- SCC TLM1 TDS	1K
MGSTISB7	- JPL/MOS Smooth	25K
MGSTISB8	- JPL/MOS Current	0
MGSTISB9	- JPL/MOS Upc'mg	0
MGTDSBC	- JPL/MOS SMC	1K
CMDBC	- xxx	1K
CMD_ACCES	- xxx	1K
VC-TTI2		21K
VC-MTDS		25K
VC-CDB	- Misc CDB Transfers	50K

		167K

Figure 6.9-3

(Post Launch Operations)

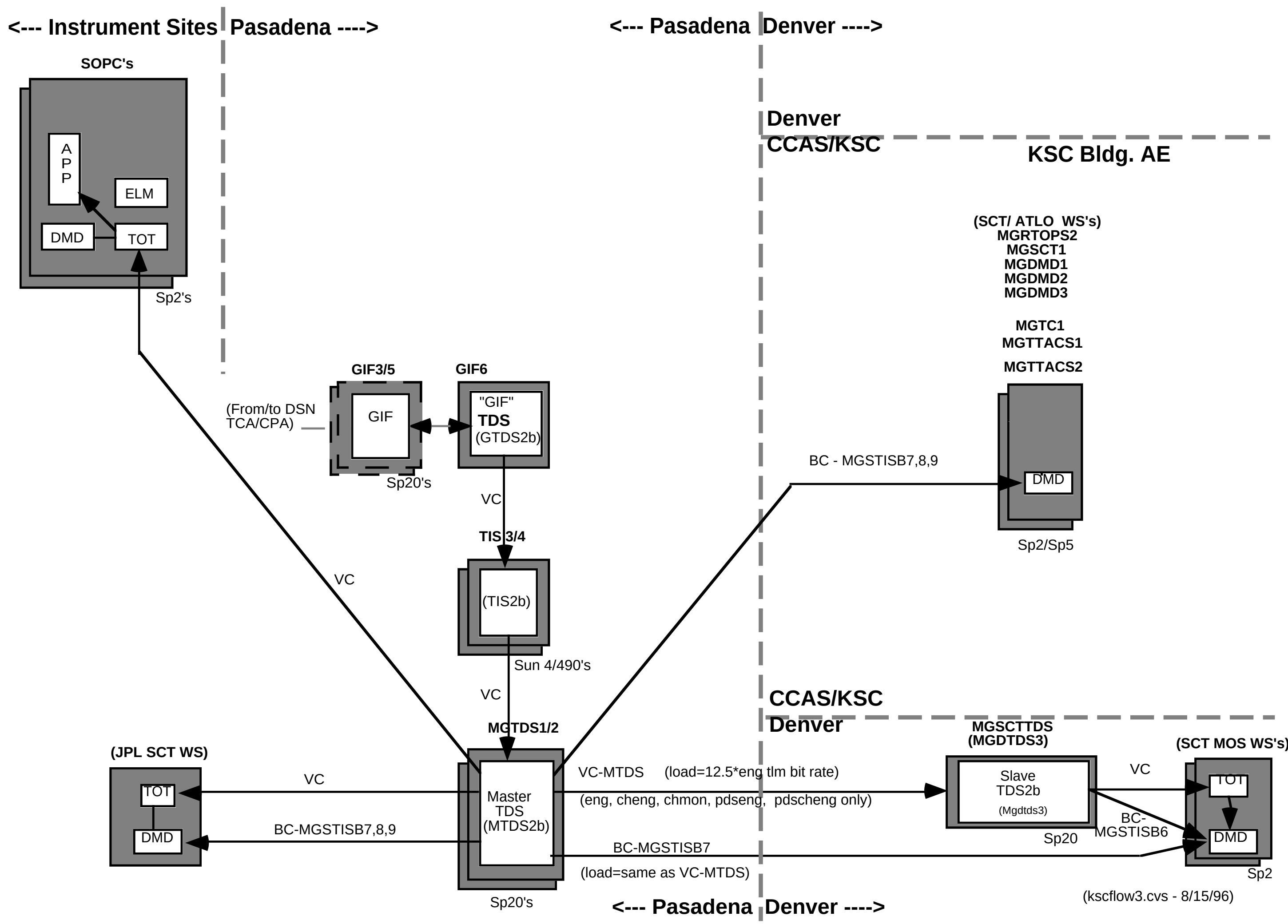
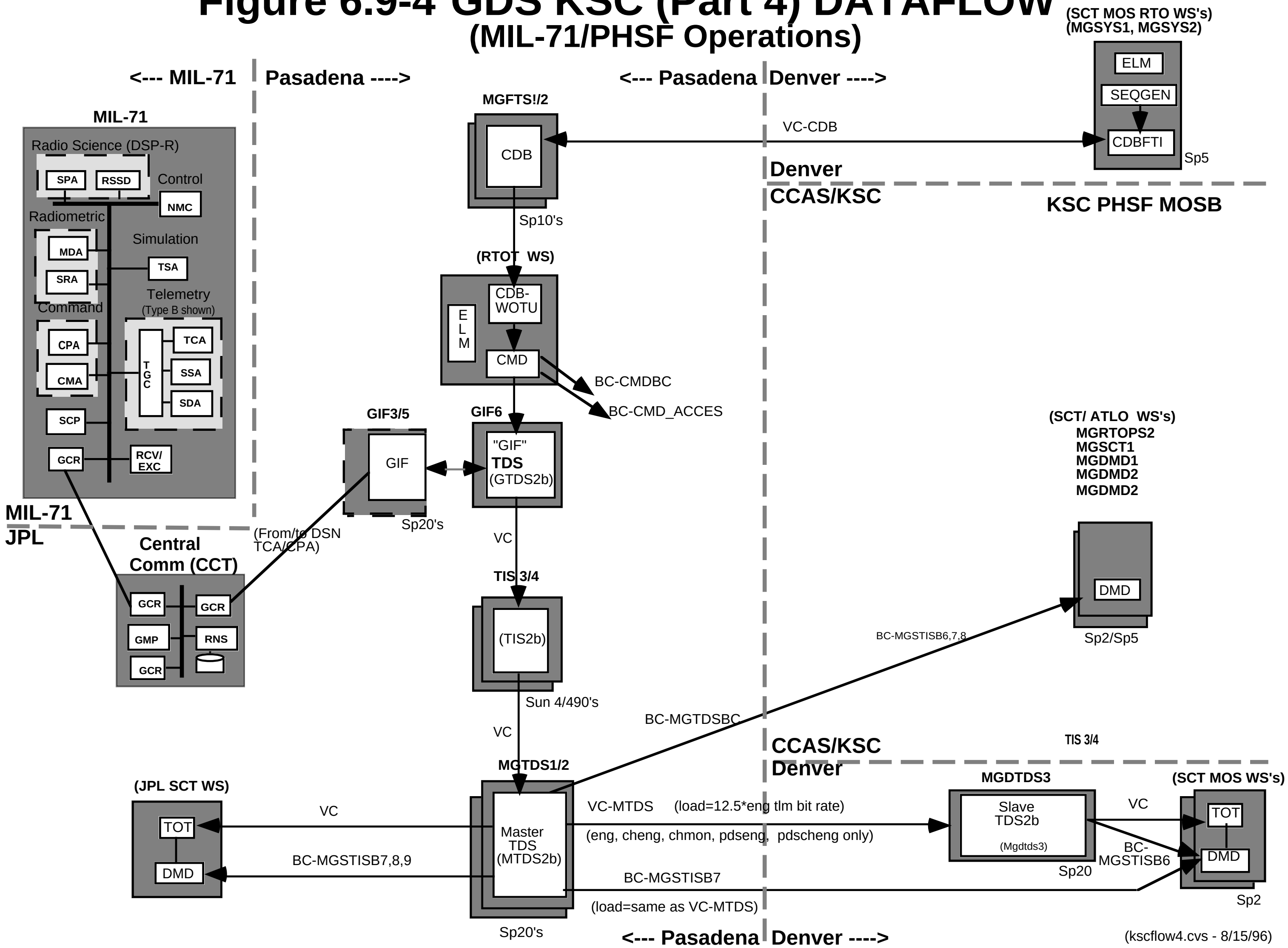


Figure 6.9-4 GDS KSC (Part 4) DATAFLOW
(MIL-71/PHSF Operations)



6.9.3 Test Participants

A. Test Engineers

FS	Frank Singleton	JPL GDS
AB	Allen Bucher	LMA GDS
BA	Bryan Allen	JPL GDS
DS	Richard Southern	JPL GDS

B. Test Conductor

DS	Richard Southern	JPL GDS

C. Multimission Support

TB	Tom Boreham	DSOT
MF	Mike Fitzpatrick	SA
YL	Young Lee	MGSO TC&DM
DR	David Recce	NOPE

D. Project GDS Support

RO	Robin O'Brien	JPL GDS
BA	Bryan Allen	JPL GDS
SW	Steve Wissler	JPL GDS SEQ
FS	Frank Singleton	JPL GDS Network
AB	Allen Bucher	LMA GDS
JJ	Jeff Jones	JPL Science Support

E. Project User Support

RL	Rob Leonard	LMA ATLO
CM	Chris Miller	LMA ATLO TC
MM	Michelle Miller	LMA ATLO TC
KM	Kyle Martin	LMA RTO

6.9.4 Test Data

Test data will be played back by the Interview Test Equipment or, when available, the MGS Spacecraft at KSC. In the event of scheduling conflicts, data from either source will be captured by the Telenex equipment and replayed back through the UconX during the actual GDS test.

6.9.5 Test Scenario

Testing will consist of 4 parts which will be conducted at different times, depending on the location of the spacecraft and ground equipment:

Part 1	PHSF Operations Dataflow
Part 2	SLC-17 Operations Dataflow
Part 3	Post-Launch KSC Operations Dataflow
Part 4	MIL-71 Operations Dataflow

PART I - PHSF Operations Dataflow

Part I-b validates the flow of telemetry data from the spacecraft/test equipment located in the PHSF High Bay at KSC to the following:

- ATLO and SCT workstations located at KSC, broadcast in near-realtime from MGTC1 TDS.
- MGS workstations located in MGS MSA at JPL, broadcast in near-realtime from JPL Master TDS.
- SCT workstations located at LMA, Denver, broadcast in near-realtime from LMA Slave TDS.
- Remote SOPCs will be able to access the JPL Master TDS.
- BCE's located at KSC will be able to display telemetry data received via MGBCE1.

Part I-b validates the command data flow for spacecraft testing at KSC with the test equipment located in the PHSF High Bay. The test conductor can retrieve SCMFs stored on mgbce1 by the SCT or Instrument Groups and transmit them to the spacecraft/test equipment via the TTACS TCI software and the UconX interface unit. Test equipment will be used to validate that the data is transferred through the UconX unit in the intended format.

PART II - SLC-17 Operations Dataflow

Part II-a validates the flow of telemetry data from the test equipment located in the SLC-17 Blockhouse at KSC to the following:

- ATLO and SCT workstations located at KSC, broadcast in near-realtime from MGTC1 TDS.
- MGS workstations located in MGS MSA at JPL, broadcast in near-realtime from JPL Master TDS.
- SCT workstations located at LMA, Denver, broadcast in near-realtime from LMA Slave TDS.
- Remote SOPCs will be able to access the JPL Master TDS.
- BCE's located at KSC will be able to display telemetry data received via MGBCE1.

Part I-b validates the command data flow for spacecraft testing at KSC with the test equipment located in the SLC-17 Blockhouse. The test conductor can retrieve SCMFs stored on mgbce1 by the SCT or Instrument Groups and transmit them to the spacecraft/test equipment via the TTACS TCI software and the UconX interface unit. Test equipment will be used to validate that the data is transferred through the UconX unit in the intended format.

PART III - Post-Launch KSC Operations Dataflow

Part III validates the telemetry data flow from the JPL Master TDS to the KSC ATLO and SCT workstations for the post-launch situation where data will be coming from the tracking stations to the Master TDS at JPL, but ATLO personnel at KSC will want to monitor the spacecraft telemetry.

- KSC ATLO and SCT workstations will be able to access the JPL TDS and display data broadcast from JPL TDS in near-realtime.

PART IV - MIL-71 Operations Dataflow

Part IV validates command, telemetry, and monitor dataflows with MIL-71. This test will use MIL-71 as the source of data, and receiver of commands, and does not involve the spacecraft or Telenex test equipment.

- Exercise dataflows associated with station configuration and setup for telemetry acquisition.
- Exercise telemetry processing capability for MIL-71.
- Display near-realtime engineering channels at LMA and JPL nodes.
- Display near-realtime engineering channels at KSC ATLO and SCT workstations.
- Display monitor data at JPL, LMA and KSC nodes.
- Extract command files from the PDB.
- Validate command interface with DSN (MIL-71) and MGSO.
- Transmit command files to MIL-71 and radiate to water load.

PART I - PHSF Uplink and Downlink Dataflow

A. Preparation (to be completed at least 48 hours prior to test execution)

1)	DS	Prepare raw telemetry files (2Kbps engineering and 4 Kbps S&E1).
2)	SCT RTO	Prepare SCMF's.
3)	AB	Stage telemetry files to Interview.
4)	TB	Verify JPL TIS, TDS ready to support test.
5)	TB	Verify LMA TDS to support test.
6)	TB	Verify JPL CMD system ready to support test.
7)	TC	Stage SCMF's on the Test Conductor's workstation (mgtc1).
8)	RO/AB	Verify JPL workstations ready to support test.
9)	SCT RTO	Verify LMA CMD and SCT workstations ready to support test.
10)	AB	Verify KSC ATLO and SCT and BCE workstations ready to support test.
11)	MF	Configure & validate routers for required dataflow & security.
12)	AB	Configure & validate interview @ KSC UconX for telemetry playback and command monitor.

B. Execution

<u>Startup</u>:

13)	DS	Verify preparations have taken place.
14)	DS	Establish voice links between JPL, LMA Denver, and KSC.

<u>Downlink</u>:

15)	RL	Initiate TTACS/MGDS downlink processes from MGTC1.
16)	RO	Start third instance of TTI.
17)	TB	Bring up TDS (Master-Slave configuration) at JPL, LMA, and KSC.
18)	DS	Request start of 2 Kbps engineering telemetry data transmission.
19)	AB	Initiate playback of 2 Kbps engineering from test equipment on UconX Port 1.
20)	TB	Verify reception of data at JPL TIS, note time.
21)	AB	Verify display of data at KSC ATLO , SCT and BCE workstations, note time.
22)	SCT	Verify display of data at LMA SCT workstations, note time.
23)	RO	Verify display of data at JPL Testbed workstation, note time.
24)	AB	Initiate 4K S&E1 dataflow from Interview to SCC UconX port 1.
25)	DS, AB	Mark time of telemetry dataflow initiation.
26)	AB	Verify S&E1 telemetry flow @ Telenex Interview test equipment on UconX Port 1.
27)	RO	Verify S&E telemetry dataflow at MGTTACS1.
28)	OS, RL, AB	Verify realtime engineering telemetry displays @ MGAACS3, MGCDH1 and MGTC1.
29)	CW	Verify near-realtime engineering telemetry display @ MGSCT1.
30)	MC, NG	Verify near-realtime packet flow to SOPC's.
31)	GE,RL,BA	Verify near-realtime delivery of instrument packets to BCE processing @ BCE2.

<u>Dataflow Termination</u>:

32)	DS	Announce Dataflow termination activity.
33)	BA	Terminate telemetry dataflow from test equipment. Note exact GMT of dataflow termination.
34)	All	As feasible, note exact GMT of dataflow termination, as viewed at each site, save all test data.
35)	RL,RO	When all recipient nodes are quiescent, terminate local downstream processes.
36)	GE,RL,BA	Terminate BCE processing .

<u>Uplink</u>:

37)	AB	Initialize test equipment to monitor command flow on KSC UconX port 3.

38)	RL	Run TCI (internal clocking @ 125 bps) to transmit SCT SCMF command messages @ MGTC1 via KSC UconX port 3.
39)	AB	Verify command message transmittal using test equipment.

C. Analysis

1)	All	Get clock ranges, # of records, # of anomaly records from: a) Preview data, b) Archive (post-test) data, c) realtime data. Compare & report discrepancies.
2)	All	Compare expected & received packet data content, as feasible.
3)	RO	Gather telemetry delivery/display latency data from participants, correlate with TIS and TTI data and test conductor data, compute latencies.
4)	AB	Review/validate channelized engineering data content, as feasible.
5)	AB	Review/validate captured command data at Interview, as feasible.

PART II - SLC-17 Uplink and Downlink Dataflow

A. Preparation (to be completed at least 24 hours prior to test execution)

1)	DS	Prepare raw telemetry files (2Kbps engineering and 4 Kbps S&E1).
2)	SCT RTO	Prepare SCMF's.
3)	AB	Stage telemetry files to Interview.
4)	TB	Verify JPL TIS, TDS ready to support test.
5)	TB	Verify LMA TDS to support test.
6)	TB	Verify JPL CMD system ready to support test.
7)	TC	Stage SCMF's on the Test Conductor's workstation (mgtc1).
8)	RO/BA	Verify JPL workstations ready to support test.
9)	SCT RTO	Verify LMA CMD and SCT workstations ready to support test.
10)	AB	Verify KSC ATLO and SCT and BCE workstations ready to support test.
11)	MF	Configure & validate routers for required dataflow & security.
12)	AB	Configure & validate interview @ KSC UconX for telemetry playback and command monitor.

B. Execution

<u>Startup</u>:

13)	DS	Verify preparations have taken place.
14)	DS	Establish voice links between JPL, LMA Denver, and KSC.

<u>Downlink</u>:

15)	RL	Initiate TTACS/MGDS downlink processes from MGTC1.
16)	RO	Start third instance of TTI.
17)	TB	Bring up TDS (Master-Slave configuration) at JPL, LMA, and KSC.
18)	DS	Request start of 2 Kbps engineering telemetry data transmission.
19)	AB	Initiate playback of 2 Kbps engineering from Telenex Interview test equipment on UconX Port 1.
20)	TB	Verify reception of data at JPL TIS, note time.
21)	AB	Verify display of data at KSC ATLO , SCT and BCE workstations, note time.
22)	SCT	Verify display of data at LMA SCT workstations, note time.
23)	RO	Verify display of data at JPL Testbed workstation, note time.
24)	AB	Initiate 4K S&E1 dataflow from Interview to SCC UconX port 1.
25)	DS, AB	Mark time of telemetry dataflow initiation.

26)	AB	Verify S&E1 telemetry flow @ Telenex Interview test equipment on UconX Port 1.
27)	RO	Verify S&E telemetry dataflow at MGTTACS1.
28)	OS, RL, AB	Verify realtime engineering telemetry displays @ MGAACS3, MGCDH1 and MGTC1.
29)	CW	Verify near-realtime engineering telemetry display @ MGSCT1.
30)	MC, NG	Verify near-realtime packet flow to SOPC's.
31)	GE,RL,BA	Verify near-realtime delivery of instrument packets to BCE processing @ BCE2.

Dataflow Termination:

32)	DS	Announce Dataflow termination activity.
33)	AB	Terminate telemetry dataflow from Interview. Note exact GMT of dataflow termination.
34)	All	As feasible, note exact GMT of dataflow termination, as viewed at each site, save all test data.
35)	RL,RO	When all recipient nodes are quiescent, terminate local downstream processes.
36)	GE,RL,BA	Terminate BCE processing .

Uplink:

37)	AB	Initialize test equipment to monitor command flow on KSC UconX port 3.
38)	RL	Run TCI (internal clocking @ 125 bps) to transmit SCT SCMF command messages @ MGTC1 via KSC UconX port 3.
39	AB	Verify command message transmittal using test equipment.

C. Analysis

1)	All	Get clock ranges, # of records, # of anomaly records from: a) Preview data, b) Archive (post-test) data, c) realtime data. Compare & report discrepancies.
2)	All	Compare expected & received packet data content, as feasible.
3)	RO	Gather telemetry delivery/display latency data from participants, correlate with TIS and TTI data and test conductor data, compute latencies.
4)	AB	Review/validate channelized engineering data content, as feasible.
5)	BA	Review/validate captured command data at Interview, as feasible.

PART III - Post-Launch KSC Operations Dataflow

In Part III, telemetry dataflows are conducted from the JPL TDS to ATLO workstations at KSC where they are displayed in near-realtime.

Dataflow to ATLO personnel at KSC from JPL. The Test Director initiates 2K Eng dataflow from the JPL Master TDS to the KSC Slave TDS (TC1) where the data is then accessed and displayed in near-realtime by the ATLO/SCT workstations at KSC. Telemetry displays are verified at the KSC ATLO/SCT workstations.

A. Preparation (to be completed at least 48 hours prior to test execution)

1)	DS	Prepare raw telemetry files (2Kbps engineering).
2)	TB	Stage telemetry data to JPL TDS.
3)	TB	Verify JPL TDS ready to support test.
4)	TB	Verify KSC TDS (mgtc1) ready to support test.
5)	AB	Verify KSC ATLO and SCT workstations ready to support test.
6)	MF	Configure & validate routers for required dataflow & security.

B. Execution

Startup:

7)	DS	Verify preparations have taken place.
8)	DS	Establish voice links between JPL and KSC.

Downlink:

9)	DS	Request start of 2 Kbps engineering telemetry data transmission.
10)	AB	Start TDS on MGTC1,
11)	AB	Verify display of data at KSC ATLO , SCT and BCE workstations.

C. Analysis

1)	BA	Compare expected & received packet data content, as feasible.
2)	AB	Review/validate channelized engineering data content, asfeasible.

PART IV - MIL-71 Operations Dataflow

A. Preparation (to be completed at least 48 hours prior to test execution)

1)	DS	Verify station schedule.
2)	TC	Verify that correct SCMF's are stored on the PDB.
3)	TC	Prepare telemetry data (2Kbps engineering and 4 Kbps S&E1).
4)	NOPE	Stage telemetry data to MIL-71.

B. Execution

Startup:

5)	DS	Verify preparations have taken place.
6)	DS	Establish voice links between JPL, LMA Denver, and KSC.
7)	NOPE	Have station validate command system.
8)	NOPE	Notify test conductor of a green command system at station.
9)	TC	Notify DSOT station green for command validation.
10)	Data Control	DSOT perform command validation.

11)	Data Control	Enter command communicator.
12)	Data Control	Notify test conductor command system is green.
13)	TC	Turn command system over to SCT RTO for commanding.
14)	SCT RTO	Login to command central and verify green command system.

Downlink:

15)	DS	Request start of 2 Kbps engineering telemetry data transmission.
16)	NOPE	Initiate playback of 2 Kbps engineering from MIL-71TPA.
17)	TB	Verify reception of data at JPL GIF, TIS.
18)	SCT	Verify display of data at LMA SCT workstations.
19)	AB	Verify display of data at KSC ATLO and SCT workstations.

Uplink:

20)	SCT RTO	Get command files from PDB.
21)	SCT RTO	Verify all files are at command WS.
22)	SCT RTO	Reformat files to cmd_dsn file.
23)	SCT RTO	Take CMA to Idle1.
24)	SCT RTO	Verify command transmitter on.
25)	SCT RTO	Verify command modulation on.
26)	SCT RTO	Transmit files to CPA and verify.
27)	SCT RTO	Attach command file to queue.
28)	SCT RTO	Take CMA to Active.
29)	SCT RTO	Verify that commands have begun to radiate to water load.
30)	SCT RTO	Verify that command confirmations are being seen on command WS.
31)	SCT RTO	Notify test conductor when all commands have radiated.

Verify Monitor Data (Mon 5-15)

32)	SCT RTO	Using the CMD display window verify that the Mon 5-15 data is being displayed.

C. Analysis

1)	All	Compare expected & received telemetry data content, as feasible.
2)	AB	Review/validate channelized engineering data content, as feasible.
3)	SCT RTO	Review/validate command radiation, as feasible.

6.9.6 Test Success Crite ria

PART I - PHSF Operations Dataflow

1) Engineering channels displayed in realtime @ TC & KSC ATLO workstations.
2) Engineering channels displayed in near-realtime at JPL workstations, LMA SCT workstations, and SOPC workstations.
3) Instrument packets received at instrument BCE's in near-realtime.
4) Uplink products prepared by TC workstation.
5) Command messages (from SCMF's) transmitted by TC workstation to spacecraft (Interview).
6) Telemetry data received from MIL-71 and displayed at JPL workstations.
7) Command messages received and processed by MIL-71 and radiated to water load.

PART II - SLC-17 Operations Dataflow

1) Engineering channels displayed in realtime @ TC & KSC ATLO workstations.
2) Engineering channels displayed in near-realtime at JPL workstations, LMA SCT workstations, and SOPC workstations.
3) Instrument packets recieved at instrument BCE's in near-realtime.
4) Uplink products prepared by TC workstation.
5) Command messages (from SCMF's) transmitted by TC workstation to spacecraft (Interview).

PART III - Post-Launch KSC Operations Dataflow

1) Engineering channels from JPL TDS displayed in near-realtime at KSC workstations.

PART IV- MIL-71 Operations Dataflow

1) Engineering channels displayed in near-realtime at JPL workstations, and LMA SCT workstations.
2) Engineering channels displayed in near-realtime @ KSC ATLO and SCT workstations.
3) Command files transmitted by MIL-71 to water load.

7.0 Test Resources

7.1 Personnel

Test personnel are identified in each individual test case. Table XXX shows test cases vs team participation:

Test Case	RTOT	SCT	SOT	NAVT	PST	MOAT
1. S/C I&T	X	X	X		X	
2. Uplink	X	X	X		X	X
3. Command	X				X	
4. Telemetry	X	X	X			
5. Tracking & RS	X		X	X		
6. Downlink	X	X	X	X	X	X
7. Navigation	X	X		X		
8. Mission Ops Assurance	X	X	X	X	X	X
9. Launch/KSC	X	X	X			

Participation Planning Assumptions :

Each test is executed twice during each assigned period.
Each team supplies 2 participants.
Each test session requires:
2 hours preparation
4 hours execution
2 hours analysis
per participant.

7.2 Facilities & Equipment

In addition to GDS components needed for operations support, some special facilities and test equipment are utilized in executing the GDS tests. These are:

1) Serial Test Equipment

2) GDS Testbed

3) DTF-21

4) TSA's

5) CPA data capture.

6) The STL

7) The MGS spacecraft and flight software.

8) The spacecraft checkout complex.

7.3 Test Data

Test data sources and products are defined in conjunction with each individual test case. In general, the data sources are:

1) MO telemetry and file data.

2) STL telemetry (EDF).

3) Telemetry from the MGS spacecraft (during ATLO).

4) MGSO Sim.

5) TSA

6) MGS GDS hardware and software

7) SIT software.

8.0 Test Metrics

The GDS test engineer will gather and maintain metrics during GDS testing.

8.1 Test Progress Metric

The test progress metric measures progress of test execution, in terms of:

Test cases planned,

Test cases executed,

Test cases passed, partially-passed, failed.

8.2 System Quality Metric

The system quality metric measures the quality of the system under test, in terms of known problems. It is not limited to problems uncovered during testing. Only criticality 1 and 2 problems are tracked.

9.0 Anomaly Reporting

Each anomaly detected during testing will be briefly analyzed at the post test briefing, and noted in the preliminary test report. If a GDS failure is suspected, an individual will be assigned to complete the analysis, and generate an appropriate anomaly report. Anomaly report identifiers and criticality assignments will be included in the final test report. The following types of anomaly reports will be generated:

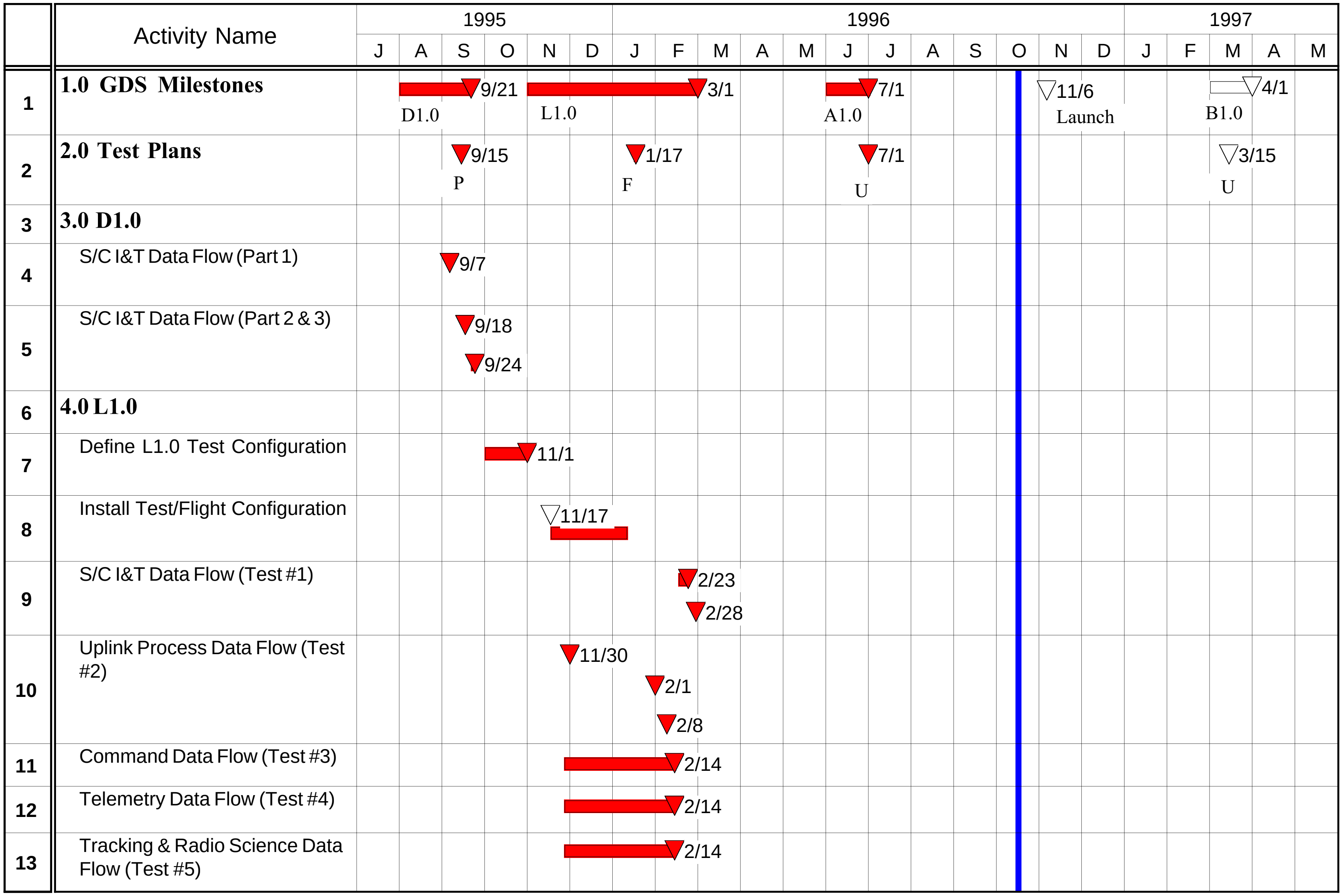
FR	Problems with MGSO components or procedures.
DR	DSN components or procedures.
Entry in test report	All FRs DR’s and configuration problems corrected during testing.

ISA’s will not be used to document problems uncovered during GDS testing.

10.0 Test Schedule

The GDS test schedule is contained in figure 7

Mars Global Surveyor
GDS Test & Integration



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Page 1
Oct 16, 1996

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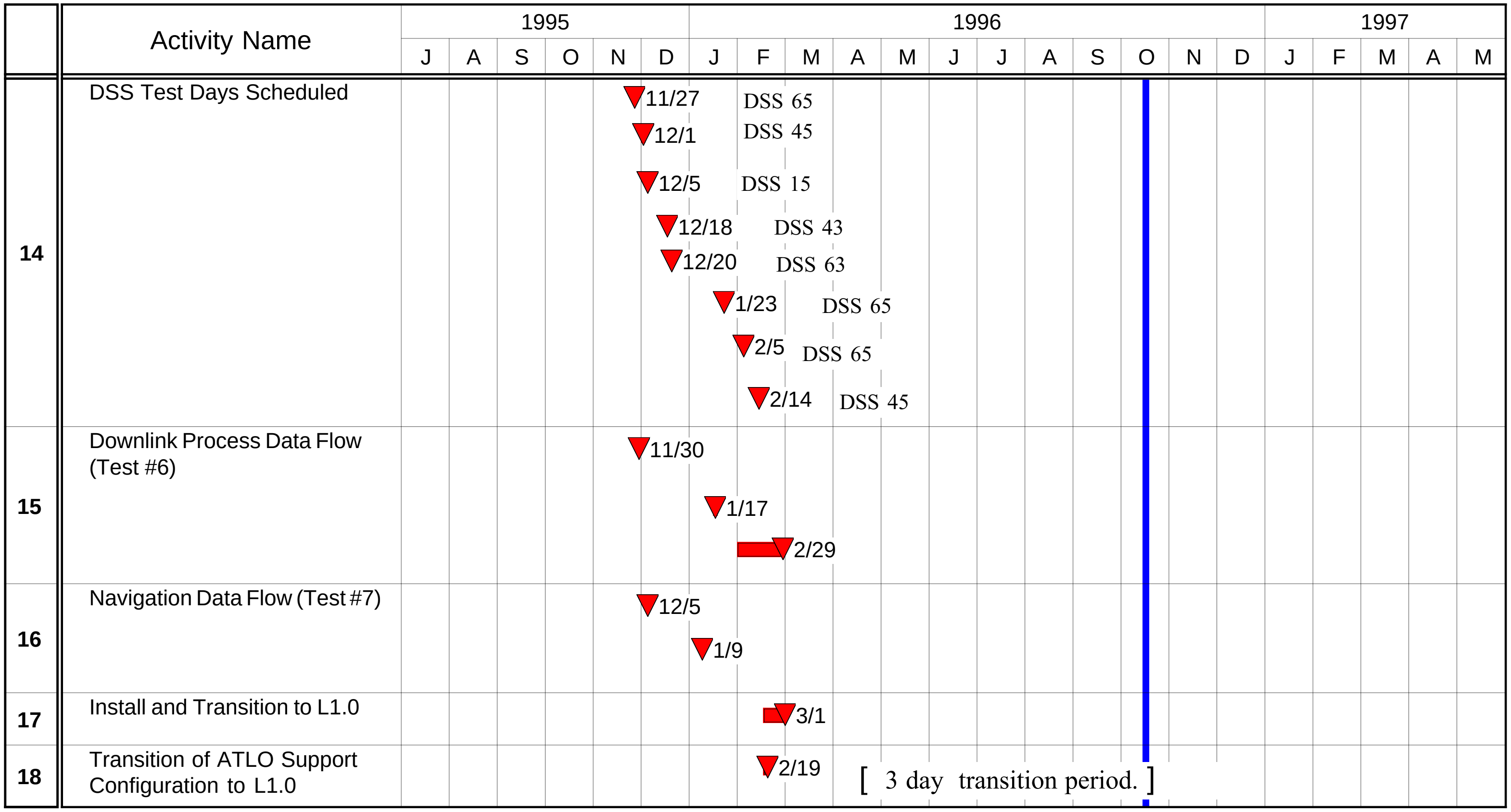
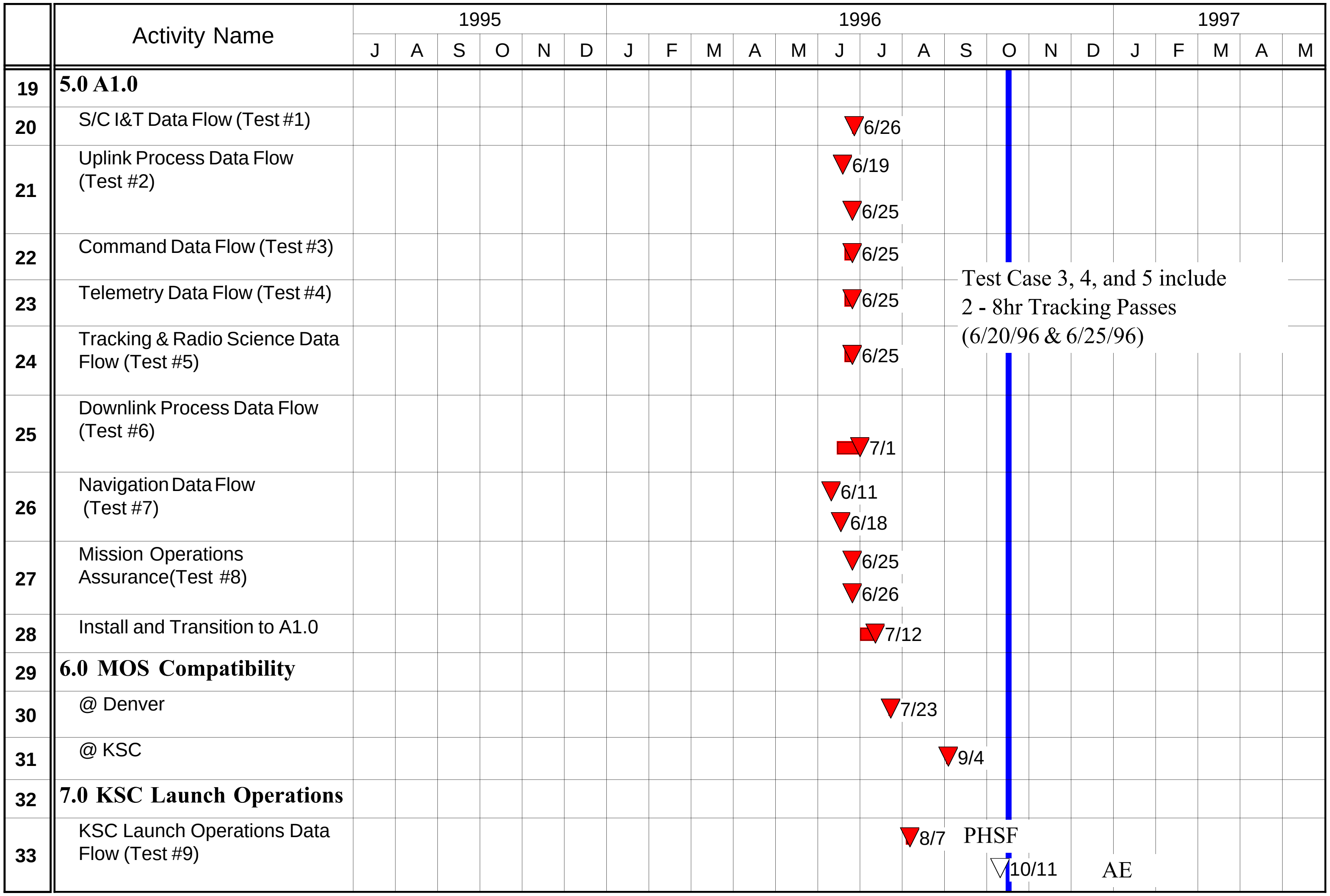


Mars Global Surveyor

Mars Global Surveyor
GDS Test & Integration



Mars Global Surveyor
GDS Test & Integration

	Activity Name	1995 J	A	S	O	N	D	1996 J	F	M	A	M	J	J	A	S	O	N	D	1997 J	F	M	A	M
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Page 4
Oct 16, 1996

Appendix A Requirements Verification Matrix

REQUIREMENT	REFERENCE	TEST CASES
1. Emergency Sequencing: SCMF on PDB, within 15 minutes of completion of SEQGEN input for 10 command SCMF.	V2-3.6-j	6.2.5.
2. Emergency Commanding (MGSO): Transmit commands (to DSN) within 10 minutes of SCMF on PDB.	V2-3.6-k	6.3.5.
3. Emergency Commanding (DSN): Radiate commands within 5 minutes of command file receipt.	V2-3.6-l	6.3.5
4. Express Commanding: Send command to S/C w/i 30 min. w/o PST.	V2-3.4.7-p, V2-3.4.10-t, V2-3.6-m	6.3.5
5. Electronic Command Request Processing & Command Tracking	V2-3.4.10-q	NA
6.		
7. 94% Data delivery by TMOD	V2-3.6-a	6.4.5
8. Induced error rate (downlink) < 1 bit in 10^7	V2-3.6-d	6.4.5
9. Packet Error/Gap rate < 1 packet in 10,000 (DSN SS->PDB), within 12 hours of data receipt.	V2-3.6-d	6.4.5
10. Telemetry, Monitor and RS data to PDB within 30 minutes.	V2-3.6-e1	6.4.5
11. Channelized Engineering data to PDB and SCT workstation within 5 minutes.	V2-3.6-e3	6.4.5
12. Reed-Soloman decoding by MGSO	V2-3.4.10-j	6.4.5
13. ERT Tagging by DSN	V2-3.4.10-l	6.4.5
14. SCLK/SCET Generation & tagging by MOSO	V2-3.4.10-l	6.4.5
15.		
16. PDB Data Transfer begins within 5 seconds (nominal), 2 minutes (peak load)	V2-3.6-o/p	6.6.5
17. PDB Online data retention: File Data: 12 weeks Stream Data: 3 weeks	V2-3.6-q	6.6.5
18. 45 concurrent PDB file transfers and 45 concurrent stream data queries.	V2-3.6-z	6.6.5
19. Aggregate file transfer rate >= 8.5 Mbytes/minute.	V2-3.6-aa	6.6.5
20. Aggregate packet query processing rate >=756 kilopackets/hour.	V2-3.6-ab	6.6.5
21. Aggregate channel query processing rate >= 933	V2-3.6-ac	6.6.5

kilopackets/hour.		
22. PDB Backup (within 24 hrs)/Recovery	3.4.11-h, 3.6-u	6.6.5
23. PDB Security	3.4.11-i	6.6.5
24.		
25. DSN deliver ODF w/i 1 hour of end-of-pass.	V2-3.6-e2A	6.5.5
26. DSN to store ODF and ATDF for 7 days, with 15 min. recall.	V2-3.4.8-j	6.5.5
27. OWLT Generation		6.7.5
28.		
29. 448 Kbps Aggregate dataflow JPL-LMA.		6.1.5
30.		
31. 224 KBPS Aggregate dataflow JPL-MOS/TES, 56K Aggregate dataflow JPL-SIT.		6.1.5
32.		
33. Automated Alarm Notification	V2-3.4.10-r	NA
34. Automated MCT Log Generation	V2-3.4.10-u	NA
35. Automated DSN Scheduling Tools		NA
36. Remote Telemetry Display	V2-3.4.10-s	NA
37. E-kernel Generation	V2-3.4.11-d	6.6.5 (?)
38.		
39. WS & Network Security	V2-3.4.12	6.1.5
40. NASCOM/Router MTTR <= 1 hour (Critical events involving Denver or KSC).	V2-3.6-y	6.1.5
41.		
42. ATLO: 224 Aggregate dataflow JPL-KSC.		6.9
43. ATLO: Instrument packets to SOPC's w/i 30 seconds.		6.9
44. ATLO: Instrument packets to BCE's w/i 10 seconds.		6.9
45. ATLO: Display realtime engineering channels to TC w/i 5 seconds.		6.9
46. ATLO: Generate Test SCMF w/i 5 minutes.		6.9
47. ATLO: Begin Command Transmission w/i 5 seconds.		6.9
48. ATLO: Concurrent 2K eng tlm, 2K eng tlm, 5K commanding.		6.9
49. ATLO: Concurrent 16K S&E tlm, 250 BPS eng tlm, 5K		6.9

commanding.		
50.		
51.		

Appendix B Component Verification Matrix

COMPONENT NAME	PROVIDER	TEST CASES
1. DSN Command System	TMOD/DSN	6.3.5
2. DSN Telemetry System a) Type A, b) Type B, 3. c) Block 5 Rec, d) 34M hef, e) 70M, f) BWG	TMOD/DSN	6.4.5
4. DSN Radiometric System	TMOD/DSN	6.5.5.4
5. DSN Radio Science System	TMOD/DSN	6.5.5.5
6. DSN Navigation System	TMOD/DSN	6.5.5
7. DSN Monitor & Control Systems	TMOD/DSN	6.5.5.6
8. DSN Network Support System (NSS)	TMOD/DSN	6.5.5.2 (SOE) 6.7.5 (Schedule)
9. DSN Ground Communications System (GCF)	TMOD/DSN	6.3.5 6.4.5 6.5.5
10. DSN Initial Acquisition System	TMOD/DSN	6.9 (?)
11. ACS (Advanced Communication Services)	TMOD	6.5.5 (TRK CDR)
12.		
13. MGSO Command System (CMD)	TMOD/MGSO	6.3.5
14. Flight GIF	TMOD/MGSO	6.3.5 6.4.5 6.5.5
15. Flight TIS (w. Config files)	TMOD/MGSO	6.4.5 6.5.5.6 (Monitor)
16. Reed-Soloman Decoder	TMOD/MGSO	6.4.5
17. Flight TDS (w. Config files), include TOT	TMOD/MGSO	6.4.5 6.5.5.6 (Monitor)
18.		

19.		
20. NOCC/CDB I/F (NTRAN)	TMOD	6.5.4
21. CDB (w. Config files), include WOTU	TMOD/MGSO	6.3.5 6.4.5 6.5.6
22.		
23. DMD (w. SCT & MCT Config files)	TMOD/MGSO, LMA	6.6.5
24. DMD (w. Nav Config files)	TMOD/MGSO	(?)
25. DMD (w. SIT Config files)	TMOD/MGSO	6.1.5 6.6
26. Browser (w. Config Files)	TMOD/MGSO	6.6
27. ELM	TMOD/MGSO	6.1.5
28. FTP	TMOD/MGSO	6.1.5
29. Telnet	TMOD/MGSO	6.1.5
30.		
31. Interview	MGS-Telenex	6.1.5
32. UconX H/W & S/W	MGS-UconX	6.1.5
33. ATLO TIS's	TMOD/MGSO	6.1.5
34. ATLO TDS	TMOD/MGSO	6.1.5
35. TCI	TMOD/MGSO	6.1.5
36. TTI	TMOD/MGSO	6.1.5
37. TTACS/ATLO Config & Scripts	JPL-394	6.1.5
38. VC-to-SOCKET (BCE) I/F	JPL-394	6.1.5
39.		
40. MGS SEQGEN	TMOD/MGSO, JPL-314	6.2.5
41. MGS SEQTRAN	TMOD/MGSO, JPL-314	6.2.5
42. REVTRAN	JPL-314	6.2.5
43. MOVTL (PEF Conversion)	JPL-314	6.2.5
44. COMPARE	TMOD/MGSO	6.2.5
45. SEQ_REVIEW	TMOD/MGSO	6.2.5
46. NIPC/ExpC	JPL-314	6.2.5

47. Scripts (EmC)	JPL-314	6.2.5
48.		
49. ODP	JPL-312	6.7.5
50. DPTRAJ	JPL-312	6.7.5
51. MOPS	JPL-312	6.7.5
52. NAIF (SPK)	TMOD/MGSO	6.7.5
53. Nav Utilities	JPL-312	6.7.5
54. OSCAR	JPL-312	6.5.5.4 6.7.5
55.		
56. WS Decom	TMOD/MGSO	6.6.5
57. NAIF (SPK,EK,IK,CK)	TMOD/MGSO	6.6.5
58. SOPC Environment	JPL-314	6.6.5
59.		
60. SPAS:TPAS	JPL-331/LMA	6.6.5
61. SPAS:Telecom/Excel	LMA	6.6.5
62. SPAS:PDS	JPL-341/LMA	6.6.5
63. SPAS:Propulsion	LMA	6.6.5
64. SPAS:Power	LMA	6.6.5
65. SPAS:Thermal	LMA	6.6.5
66. SPAS:Temp	LMA	6.6.5
67. SPAS:StarCat	LMA	6.6.5
68. SPAS:Ephemeris	LMA	6.6.5
69. SPAS:MNVR	LMA	6.6.5
70. SPAS:Attitude (Profile, Recon)	LMA	6.6.5
71. SPAS:Memory/Parameter Tracking	LMA	6.6.5
72. SPAS:Momentum	LMA	6.6.5
73. SPAS:Tlm/Cmd Editor/Viewer	LMA	6.6.5
74. FSW Maintenance Tools	LMA	(?)
75. SCT Environment	TMOD/MOSO, LMA	6.1.5 6.6.5

76.		
77. PFOC (MGS)	JPL-521	(?)
78. ACT	JPL-391	NA
79. DSN Sched	TMOD/MGSO	6.5.5.1
80. CM Tools	JPL-311	(?)
81. OLOG	TMOD/MGSO	NA
82. Remote PC	JPL-394	NA
83. AutoAlarm	TMOD/MGSO	NA
84. MGS SEGS	JPL-391	6.5.5.2
85.		
86. SCT Workstations and comm lines	TMOD/MGSO, TMOD/DSN, MGS	6.6.5
87. PST Workstations	TMOD/MGSO, MGS	6.2.5
88. MCT Workstations	TMOD/MGSO	6.3.5 6.4.5 6.5.6
89. NAV Facility & Workstations	TMOD/MGSO, MGS	6.7.5
90. SIT Workstations (SOPC's) and comm lines	TMOD/MGSO, TMOD/DSN, MGS	6.1.5 6.6.5
91. ER and Science Support Workstations	TMOD/MGSO, MGS	6.4.5 6.5.5 6.6.5
92. DAT Workstations	TMOD/MGSO, MGS	6.3.5 6.4.5 6.5.5 6.6.5
93. Ops Support Workstations	TMOD/MGSO, MGS	6.3.5 6.4.5 6.5.6
94. TTACS Config (SCC)	TMOD/MGSO, MGS	6.1.5
95. TTACS Config (STL)	TMOD/MGSO, MGS	6.1.5
96.		
97. (Instrument BCE's)	SIT's	6.1.5
98. (STL)	LMA	6.1.5
99. (FSW Maint Facility)	LMA	6.1.5
100.(RSST)	JPL-331	6.5.5.5

101.(SIT Software)	SIT's	6.1.5 6.6.5
102.(S/C Command System)	LMA	6.1.5
103.(S/C SEQ System)	LMA	6.1.5
104.(S/C Telemetry System)	LMA	6.1.5
105.(S/C RF Subsystem)	LMA	6.1.5
106.(KSC Data Lines)	DSN, MILA, KSC	6.9
107.(Delta Launch Support Facilities)	MDAC, KSC	6.9

Appendix C Interface Verification Matrix

INTERFACE NAME	DESCRIPTION	REF	CH	PDB	PRODUCERS	RECIPIENTS	TEST CASES
1. DSN Viewperiod File	Station viewperiods of S/C	DAC001		DSN_ VIEWPERIODS	NOCC/NSS	SEQGEN, SEGS	6.5.5.1
2. DSN Allocation File	7-day & 8 wk Station Allocations	DAC003		DSN_ CURRENT_ WEEK_ CHANGE_LOG, DSN_ CURRENT_ WEEK_ SCHEDULE, DSN_EIGHT_ WEEK_ SCHEDULE, DSN_ FORECAST_ WEEK_ SCHEDULE	NOCC/NSS	SEQGEN, SEGS	6.5.5.1
3. Archival Tracking Data File (ATDF)	Raw Radiometric Data (Processed into ODF/ASTD)	DAC004		TRACKING_ DATA_FILE	NOCC/NAV		6.5.5.4
4. Orbit Data File (ODF)	Processed Doppler, Ranging, etc.	DAC005		ORBIT_DATA_FILE	NOCC/NAV	ODP, RSIT S/W	6.5.5.4
5. Media Calibrations Data File	Radiometric Corrections for Ionospheric, Tropospheric and Solar Effects	DAC006		DSN_ IONOSPHERE_CALIBRATION, DSN_ TROPOSPHERE_CALIBRATION	NOCC/NSS	ODP	6.5.5.4
6. Time and Polar Motion File	Describes Earth and Polar motions for radiometric corrections	DAC007		DSN_TIME_ POLAR_ MOTION	NOCC/NSS	DPTRAJ	6.5.5.4
7. Tracking Station Locations	Station coordinated & error covariances.	DAC009		?	NOCC/Editor	RSIT S/W	(?)

(STALOC)							
8. S/C Channelized Engineering Data	CHDO format for delivery of engineering channels (specific channel definitions are in MGS Telemetry Dictionary, and are reflected in Tlm Decom Maps and CCL files)	DAC012		N/A	TIS, TDS/TOT	DMD, SPAS	6.4.5
9. Channelized Monitor Data	CHDO format for delivery of DSN monitor channels (specific channels are defined in DSN MON-5-15 and are reflected in Mon Decom Maps and CCL files)	DAC013		N/A	TIS, TDS/TOT	DMD	6.5.5.6
10. Engineering Channel Parameter Table (CPT)	Specific information regarding each engineering channel (type, limits, alarm thresholds, etc)	DAC016		CPT	Cmd/Tlm-Dict Editor,Viewer	DMD	6.4.5
11. Channel Conversion Language File (CCL)	Defines derived channels, DN/EU conversions and other special channel processing	DAC017		CCL	Cmd/Tlm-Dict Editor,Viewer	DMD	6.4.5
12. DSN Tracking Weather Data Interface (TRK-2-24)	Station Weather data, for use by Radio Science	DAC020		DSN_ WEATHER_ DATA	TSAC?	RS SIT S/W	6.5.5.4
13. DSN-Formatted Command File	DSN-compatible command file (containing radiatable	DAC025		CMD_DSN	MOSO CMD	DSN CPA	6.2.5 6.3.5

(CMD_DSN)	command elements)						
14. Decomutation Map	Format for specifying channel locations and ID's (Tlm, RS, Mon)	DAC029		DECOM_MAP_SOURCE	Cmd/Tlm-Dict Editor,Viewer, Text Editors	TIS, WS Decom	6.4.5. 6.5.5.4 6.5.5.6
15. Expanded Channelized Data Record (ECDR)	Lowest-level format/information for channelized stream data	DAC037		N/A	DMD	DMD, SPAS	6.4.5
16. S/C Eng Telemetry Packet	Engineering Telemetry Packets	DAC040		N/A	TIS, TDS, STL	TDS, Browser, WS Decom	6.4.5
17. Raw Telemetry Input to TIS	GIF-Processed Data Output (SFOC-5-TIS-*DU-MOSFDU) Note: This is not the same as the old DAC043.	new		N/A	GIF, TTI	TIS	6.4.5
18. Radio Science SCP Data (& Decom Map)	Radio Science channelized SCP Data (RS "monitor" data - RSC-11-12)	DAC044/ DAC045		?	TIS	DMD	6.5.5.5
19. Radio Science Open Loop Data	Radio Science Open Loop Data "Blocks" (RSC-11-11)	DAC046		N/A	TIS, TDS	RS-S/W (Stanford)	6.5.5.5
20. ASCII S/C Tracking Data File (ASTD)	Doppler & Ranging data from DSN via OSCAR (TRK-2-27) Essentially the same content as DAC005 (ODF)	DAC047		N/A	DSN_NAV via OSCAR	ODP	
21. TTACS-S/C-GSE Command & Data Interface	Serial command & data interface between TTACS (UconX) and GSE (CDIF)		√	N/A	TTACS (Cmd), GSE (Tlm)	GSE (Cmd), TTACS (Tlm)	6.1.5

22. TTACS-Instrument BCE Telemetry Interface	Near-realtime delivery of packets from TTACS to Instrument BCE's via TCP socket interface.		√	N/A	TTACS	Instrument BCE S/W (on UNIX/DOS WS's on BCE LAN	6.1.5
23. SPICE E-Kernel (EK)	Spice E-kernel (ancillary instrument/mission-related events for science analysis & products)	DSR001		MO-M-SPICE-6-EK-<variable>-V1.0	NAIF Tools & Editors	NAIF Tools & Editors	6.6.5
24. MAG/ER Packets	SFDU-formatted MAG/ER Packets	DSR004		N/A	TIS, TDS	MAG/ER S/W, Browser, (WS Decom)	6.4.5
25. TES Packets	SFDU-formatted TES Packets	DSR005		N/A	TIS, TDS	TES S/W, Browser, (WS Decom)	6.4.5
26. MOC Packets	SFDU-formatted MOC Packets	DSR006		N/A	TIS, TDS	MOC S/W, Browser, (WS Decom)	6.4.5
27. MOLA Packets	SFDU-formatted MOLA Packets	DSR007		N/A	TIS, TDS	MOLA S/W, Browser, (WS Decom)	6.4.5
28. S/C Clock Coefficients File (SCLK/SCET)	Correlations between S/C clock and associated GMT, with calculated S/C clock rates	DSR017		SCLK_SCET	DPS-SCEGEN	TIS, CMD, SEQGEN, SPAS, SIT S/W	6.6.5
29. SPICE Leapseconds File (LSK)	Leapseconds info used to convert UTC time to Ephemeris Time	DSR019		MO-M-SPICE-6-LSK-V1.1	Text Editors	NAIF Toolkit	(?)

30. SPICE Spacecraft Clock File (Spice SCLK)	S/C clock info used to convert UTC time to Ephemeris Tike	DSR020		MO-M-SPICE-6-SCLK-V1.1	NAIF_MAKCLK	NAIF Toolkit	(?)
31. Angular Momentum Desaturation File (AMD)	Information regarding predicted S/C angular momentum desaturation events	EA003		ANGULAR_ MOMENTUM_DESAT	SPAS	DPTRAJ	6.6.5 (?)
32. Spacecraft Reconstructed Attitude (Spice C-Kernel)	Reconstructed S/C quatrains and body rates in SPICE format	EA007		MO-M-SPICE-6-CK-V1.0	? (was ATTREC for MO)	SIT S/W, NAIF Toolkit	6.6.5
33. Maneuver Performance Data file (MPDF)	Spacecraft-specific information for a particular Maneuver (mass, thrust [magnetite, direction], etc)	EA008		MANEUVER_ PERF	SPAS	MOPS	6.6.5
34. Navigation Engineering Information File (NEIF)	ASCII information regarding orientation of S/C components for solar pressure modeling	EA011		NAV_ ENGINEERING_INFO	Text Editor (SPAS)	Text Editor (DPTRAJ)	6.6.5
35. Maneuver Implementation/Reconstruction File (MIF)	Specific plan for implementing maneuver on S/C (response to MPF), or reconstructed maneuver execution	EA014		MANEUVER_ IMPL	SPAS	MOPS	6.6.5
36. MGS Telecom Performance Predictions	Telecom performance predictions from TPAP	EA019		TELEMCAP	TPAS	? (MMCT TOPS, DSNOT)	6.6.5
37. Telemetry Dictionary (TD) (Distribution)	Various formats for distribution of the Telemetry Dictionary (includes telemetry	EA020	√		MM Tlm/Cmd Editor/Viewer (FOXPRO),	WORD, FOXPRO, Text Editor,	

	calibration info). The _WORD files contain the test portion of the TD. The other files contains different formats of the DB portion of the TD				WORD	GP DBMS	
38. Command Dictionary (CD) (Distribution)	Various formats for distribution of the Command Dictionary. The _WORD files contain the test portion of the CD. The other files contains different formats of the DB portion of the CD	EA021	√		MM Tlm/Cmd Editor/Viewer (FOXPRO), WORD	WORD, FOXPRO, Text Editor, GP DBMS/SS	
39. Block Dictionary (BD) (Distribution)		EA022	√		WORD	WORD, Text Editor	
40. Spacecraft Flight Rules (S/C FR) (Distribution)	Various formats for distribution of the Spacecraft Flight Rules. The _WORD files contain the test portion of the S/C FR. The other files contains different formats of the DB portion of the S/C FR.	EA023	√		MM Tlm/Cmd Editor/Viewer (FOXPRO), WORD	WORD, FOXPRO, Test Editor, GP DBMS/SS	
41. Payload Flight Rules (Payload FR) (Distribution)	Combined LMA and SIT flight rules for payload operations.	EA024	√		WORD	WORD	
42. Launch Polynomials (LP)	Predict polynomials for LV ascent, used for	LU001	√	N/A	MACDAC	NOCC/NSS, DPTRAJ/ICPREP	6.7.5 (?)

	initial acquisition and tracking						
43. Intercenter Vector Exchange (ICV)	Near-realtime updates to pre-injection trajectories (DSN-TRK-2-17)	LU003	√	N/A	MACDAC	NOCC/NAV	6.7.5
44. Station Polynomial File (STATRJ)	Station-relative trajectory data for use in telecom link analysis	NA001		STATRJ	DPTRAJ	TPAS	6.7.5
45. Light Time File (OWLT)	Correlation of SCE time with associated up-leg and down-leg times	NA002		LIGHTTIME	DPTRAJ	CMD, SEQ, SIT S/W, SPAS	6.7.5
46. Orbit propagation & Timing Geometry File (OPTG)	Contains predicted orbital geometric events & times (apoapsis, ingress, etc)	NA003	√	OPTG	DPTRAJ	SEQGEN, SPAS	6.7.5
47. Planetary Ephemeris File (PEFILE)	Planetary Ephemeris	NA004		PLANET_ EPHEMERIS	? (Sec 313)	TPTRAJ, NOCC/NAV	(Delete in favor of SPK)
48. Maneuver Profile File (MPF)	Ideal Maneuver Parameters (direction, magnitude, etc)	NA006		MANEUVER_ PROFILE	MOPS	SPAS	6.7.5 (?)
49. SPICE Planetary Constants Kernel File (PcK)	Target body physical and cartographic constants (Derived from P-kernel)	NA007		MO-M-SPICE-6-PCK-V1.1	Text Editor (NAV)	NAIF Toolkit, SIT S/W, SPAS	6.6.5
50. Astrodynamic Constants and Initial Conditions File (ASTROCON)	Contains astrodynamic constants such as “Mars Oblateness”, precise value for an “AU”, etc.	NA008		ASTRO_ CONSTANTS	Nav Util (Astrocon)	?	6.7.5

51. Spacecraft Ephemeris File (P-File)	Predicted Spacecraft trajectory. & ancillary information	NA009		(OSCAR)	DPTRAJ	NOCC/NAV	6.7.5
52. SPICE Spacecraft, Planetary (& Satellite) Kernel File (SPK)	Predicted & Actual trajectories of spacecraft, planets and satellites.	NA011		MO-M-SPICE-6-SPK-V1.1	NAIF	SPAS, SIT S/W, NAIF Toolkit	6.7.5
53. Predicted Events File (PEF & VPEF)	Predicted spacecraft events (C&DH command execution, etc).	PS001		SEQ_ PREDICTED_ EVENTS	SEQGEN	SEGS	6.5.5
54. Sequence of Events File (SOE)	Integration of Subsets of SEQ PEF, DSN Viewperiods and Allocations, OWLT	PS002		SOE	SEGS	SEGS, Test Editors	6.5.5
55. Space Fight Operations Schedule (SFOS)	High-level graphical timeline representing a subset of SOE events	PS003		SFOS	SEGS, SFOSEDIT	SFOSEDIT, Text Editor, Hardcopy	(defer) 6.5.5
56. Spacecraft Command Message File (SCMF)	Contains a representation of uplinkable command bit stream, for a particular command load.	PS004	√	SCMF	SEQTRAN	CMD, TCI, STL	6.2.5 6.3.5
57. DSN Keywords File (DKF)	Contains DSN control directives for station equipment. Derived from subset of SOE.	PS005		DSN_ KEYWORDS	SEGS	NOCC/NMC, Text Editors	6.5.5
58. Cumulative (SEQ) Memory Map	Contains predicted S/C sequence memory contents at sequence load time.	PS008		SEQ_MEMORY_MAP	SEQTRAN	SEQTRAN	(?)

59. Spacecraft Activity Sequence File (SASF)	Contains sequence requests and parameters. Can be iteratively edited using SEQGEN.	PS010		SPACECRAFT_ACTIVITY_ SEQUENCE, +bins: _MAG, _MOC, _MOLA, _TES, _PDS, _PST, _SCT	SEQGEN, SPAS, PDS GSW, SIT S/W	SEQGEN	6.2.5
60. Spacecraft Sequence File (SSF)	Spacecraft commands and block calls, used by SEQTRAN to generate stored sequence memory loads, resultant uplink commands, and realtime command loads.	PS011		SC_SEQUENCE	SEQGEN	SEQTRAN	6.2.5
61. SEQTRAN Desired Memory Words File	A representation of a sequence load, as actually stored in S/C memory.	PS013		SEQ_DESIRED_MEMORY_ WORD	SEQTRAN	? (SPAS)	6.2.5
62. SEQ Trigger File	General purpose spec for inputting ‘triggers” to SEGS	PS017		SOE_TRIGGER	? (SPAS, RS S/W, editors)	SEGS	6.2.5
63. SPICE Instrument Kernel (I-k)	Instrument parameters (op codes, pointing, etc)	SS001		MO-M-SPICE-6-IK-V1.1	NAIF Templates, Text Editor	NAIF Toolkit, Sci Analysis S/W	6.6.5
64. Instrument Status Report & Power Profile		SS004, SS005		INSTRUMENT_STATUS, INSTRUMENT_POWER_ PROFILE	Text Editor	Text Editor	6.6.5
65.							
66.							

Appendix D Function Verification Matrix

Spacecraft Team Functions:

FUNCTION	TEAMS	TEST CASES
1. S/C Health Monitoring (include PDS)		
2. S/C Performance Analysis		
3. Telecom Performance Analysis		
4. S/C Anomaly Investigation (w. STL)		
5. Propulsive Maneuver Planning & Analysis		
6. Flight Software Maintenance		

Sequencing Functions:

7. Stored Sequence Planning		
8. Stored Sequence Implementation (process, merge, check, ...)		
9. Ground Ops Products Generation		
10. Non-stored command processing		
11. Command Request Generation		
12. Flight Sequence Validation (incl. STL)		
13. Non-Interactive Payload Commanding (NIPC)		
14. Emergency Commanding		

Navigation Functions:

15. Trajectory & Orbit Determination		
16. Produce & Distribute Nav Products		
17. Propulsive Maneuver Planning, Monitor & Analysis		

Realtime Multimission Downlink Functions:

18. Telemetry Acquisition, Processing & Routing		
19. Monitor Data Generation & Routing		
20. Radio Science Data Acquisition, Processing & Routing		
21. Tracking Data Acquisition, Processing & Routing		

Realtime Uplink Multimission Functions:

22. Command Processing & Radiation		
23. Command Tracking & Verification		

Data Management & Interchange Functions:

24. Stream Data Storage, Management and Distribution (Sci Packets, Eng Channels, Monitor Channels, Radio Science Blocks and Channels)		
25. File Data Storage, Management, Interchange and Distribution		
26. Time Correlation File Generation		
27. Data Recall/Merge (ODR, CDR)		
28. Electronic Message and Document Interchange		

Operations Management Functions:

29. Operations Resource Management & Scheduling		
30. Security		
31. Anomaly Management		

Science Instrument Operations Functions:

32. Science Instrument Operations Planning		
33. Science Instrument Commanding		
34. Science Instrument Health Monitoring		
35. Science Analysis		

ATLO Functions:

36. ATLO Commanding		
37. ATLO Telemetry Processing		
38. ATLO Data Management and Interchange		

APPENDIX E
WORKSTATION CONFIGURATION FOR L1.0 TESTING

MGS Team	D1.0 ATLO Support (DDO V19.0.5)	L1.O Test Configuration (TC&DM V21)
SOT		
MGS	mgmoc (moc)[1] mgmag (momag) mger1 (moer1)	mgmola (mola) mgtes (motes) mgrs (mors) mgsost (mosost) mger3
M/M		mmrs (multimission)
SCT	mgstldmd (mgtc1) mgtif1	
	mgtc1 mgttacs1 mgttacs2 mgdist1 mgbce1	
	mgaacs1 mgaacs2 mgaacs3 mgcdh1 mgops1 mgpower1 mgprop1 mgsa1 mgsys1 mgtel1 mgtemp1	mgaacs4 mgcdh2 mgpower2 mgprop2 mgsys2 mgtel2 mgtemp2
@JPL	mgsct1	mgsct2 (1/96)
SEQ	mgseq2 (moseq2) mgseq3	mgseq1 (moseq1) mgseq4 mgseq5
NAV		mgnav1 (monav1) mgnav2 (monav2) mgnav3 (monav3) mgnav4 (monav4) mgnav5 mgnav6

[1] Node names in parenthesis are the old MO system names.

APPENDIX E (CONTINUED)
WORKSTATION CONFIGURATION FOR L1.0 TESTING

MGS Team	D1.0 ATLO Support (DDO V19.0.5)	L1.O Test Configuration (TC&DM V21)
RTOT		
MGS		mgrtops2 (moarc2)[2] mgrtops3
M/M		DSOT Workstations GIF 1 & 2 TIS MC Workstations
DAT		
MGS		mgarc1 (moarc1) mgda1
M/M		PDB: TDS1 & 2 FTS1 & 12
DSN		DSN DSCC DSN GCF DSN NOCC

[2] Node names in parenthesis are the old MO system names.

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